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PURPOSE/INTENT

The implementation of a statewide trail system requires consistency of quality and design throughout Iowa. Trail users from across the state and throughout the nation should be able to expect a safe, user-friendly, and accessible trail no matter where in Iowa they travel. In order to encourage the implementing agencies and organizations to create high-quality trail facilities, the Iowa Department of Transportation (Iowa DOT) has compiled a series of design guidelines. These guidelines will be primarily applied in the implementation of trails in the statewide system and other trails that receive funding through the Iowa DOT, but they may also be useful as a design guide for other local trail initiatives.

Trail guidelines are recommendations set forth to help agencies, local communities, and trail organizations to locate, design, interpret, and maintain trails. Because they are based on guidelines established by the American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration (FHWA), the U.S. Architectural and Transportation Barriers Compliance Board (U.S. Access Board), and other state agencies and trail organizations, these guidelines can be considered the best practice recommendations possible. Deviations from the design guidelines will require documentation to the Iowa DOT if the project is funded through the Iowa DOT.

The limitation of design guidelines lies in the fact that any accepted guideline will have exceptions, necessitated by local conditions, community desire, changing trends, intensity of use, and many other factors. The strength of design guidelines, however, is that they offer an easy-to-use summary of extensive design expertise, and they allow for flexibility in dealing with site-specific issues without the rigid process associated with design standards. Trail design guidelines should be

considered in light of site-specific issues. Each trail project must consider which design guidelines are applicable, and under what conditions the trail should deviate from the guidelines in order to increase user safety or decrease impact to existing conditions.

When planning trails, agencies should strive to create environments and experiences that are inclusive of all people. To ensure that Iowa's trails meet the needs of all potential users, these design guidelines address a broad spectrum of ability levels and routinely integrate the needs of children, older adults, and people with disabilities. In addition to following these recommendations, designers are encouraged to directly involve trail users of all abilities and ages within their community early on and throughout the trail development process.

GOALS

The *Iowa Trails 2000* design guidelines are established to help accomplish the following goals:

- **INCREASE USER SAFETY** by recommending appropriate trail widths, sight lines, clear zones, and other design considerations.

- **INCREASE USER COMFORT** by recommending trail widths, rest areas, trail surfaces and other elements that contribute to a positive user experience.

- **PROMOTE UNIVERSAL ACCESS** by developing trails that are beneficial to users with a broad range of skill levels and abilities, including people with disabilities, children, and older adults.

- **PROMOTE STATEWIDE CONSISTENCY** by setting forth one set of guidelines and encouraging trail implementers to follow them wherever possible.

- **REDUCE COST AND INCREASE EASE OF FACILITY MAINTENANCE** by recommending trail widths, access points, and other elements that accommodate maintenance equipment and crews.

- **REDUCE LIABILITY** by following generally accepted design guidelines being used with success nationwide.

- **ENSURE COMPATIBILITY WITH ROADS AND HIGHWAYS** by setting forth specific guidelines for trail facilities within highway rights-of-way, including bicycle lanes and paved shoulders.

- **RECOGNIZE VARIOUS USER MODES** by setting forth specific guidelines relating to walking/hiking, bicycle, in-line skating, equestrian, snowmobile, off-highway vehicle, motorcycle, and canoe trails.

- **RECOGNIZE VARIOUS USER SKILLS** by recommending different trail types for different skill levels, especially in the case of bicycle trails.

- **MINIMIZE IMPACTS** to natural resources and private land by setting forth recommendations for trail location and mitigation strategies.

- **ENSURE THE LONG-TERM VIABILITY OF TRAILS** by recommending good planning and design practices.

USERS OF THE DESIGN GUIDELINES

The *Iowa Trails 2000* statewide trails vision will be planned, designed, and implemented by state agencies, local governments, and trail groups. The usefulness of these design guidelines, therefore, extends far beyond the Iowa DOT. The following groups are likely to use the *Iowa Trails 2000* design guidelines:

- **POLICY-MAKERS** at various levels will use the design guidelines to plan for future trail development, especially relating to right-of-way or easement acquisition and corridor preservation.

- **TRAIL PLANNERS,** both public entities and private consultants, will use the design guidelines to make recommendations for roadway crossings, possible corridors, accommodation of various user modes, and other issues.

- **TRAIL DESIGNERS,** including private consultants, will use the design guidelines in the construction documentation process when dealing with trail alignment, profile, width, cross-section, and surface.

- **CONCEPT/APPLICATION REVIEWERS** will use the design guidelines to evaluate the trail for funding. As stated above, deviation from the design guidelines is possible, but priority may be given to trails that follow the design goals of the statewide system.

- **TRAIL MAINTENANCE AND OPERATIONS AGENCIES/ ORGANIZATIONS** will use the guidelines in the day-to-day operation of the trail by maintaining appropriate clear zones, surface condition, and access points.

RESOURCES

Many national and state agencies and plans have set forth design guidelines. Oftentimes, these guidelines, as in the case of those written by AASHTO, are the result of extensive testing and evaluation. They are, therefore, an invaluable resource for trail planners and designers. The *Iowa Trails 2000* design guidelines rely heavily on these resources, adapting them, where necessary, to specific conditions and policies in the state of Iowa. Major sources of design guidelines include the following documents.

- **GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES**, American Association of State Highway and Transportation Officials (AASHTO): 1999 (hereafter referred to as the AASHTO Guide). This is the recognized standard for bicycle design guidelines. Updated in 1999, this document contains the most current recommendations available. In addition, trails which will receive federal transportation funding must adhere to these AASHTO guidelines.

- **MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES**

- **A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS "GREEN BOOK,"** AASHTO. This resource offers design details for Interstate and Primary Road design.

- **IOWA DESIGN MANUAL,** Iowa Department of Transportation, Office of Design. This document offers details and procedures for the design of transportation facilities in Iowa.

- **Recommendations for Accessibility Guidelines: Outdoor Developed Areas Final Report**, U.S. Architectural and Transportation Barriers Compliance Board (U.S. Access Board): 1999. This document is the final report of the Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Areas. This committee developed accessibility recommendations through a consensus process for a variety of outdoor areas, including trails. The U.S. Access Board will use the committee's recommendations, in conjunction with public comment, to develop standards for compliance with the Americans with Disabilities Act (ADA). Until standards are developed, this report contains the best information for meeting the requirements of the ADA.

- **Designing Sidewalks and Trails for Access: Part II of II: Best Practices Design Guide**, Federal Highway Administration (FHWA): 2000. This document provides detailed planning and design recommendations for developing pedestrian and non-motorized multi-use trails that meet the needs of a broad spectrum of users, including people with disabilities. This document also contains background information regarding user needs, the benefits of universal design, and recreation equipment used by people with disabilities.

- **Selecting Roadway Design Treatments to Accommodate Bicycles**, Federal Highway Administration: 1994. This is primarily a planning document for bicycle facilities, but also offers general design guidelines. This document makes frequent reference to the AASHTO Guide described above.

- **MINNESOTA BICYCLE TRANSPORTATION PLANNING AND DESIGN GUIDELINES**, Minnesota Department of Transportation: 1996. This document offers both planning guidance and design guidelines. It is nationally recognized for its detailed guidelines dealing with roadway crossings.

- **OREGON BICYCLE AND PEDESTRIAN PLAN**, Oregon Department of Transportation: 1995. This is a detailed, well-organized planning and design guide. It is known for innovative recommendations for pedestrian and bicycle accommodation with traffic calming and expressway interchanges.

- **PORTLAND PEDESTRIAN DESIGN GUIDE**, City of Portland, Oregon, Office of Transportation: 1998. This guide focuses on the accommodation of pedestrians in urban areas.

- **HENNEPIN COUNTY BICYCLE TRANSPORTATION PLAN**, Hennepin County, Minnesota, Department of Public Works: 1996. This document gives an extensive array of guidelines for the implementation of bicycle facilities within road rights-of-way.

- **TRAILBUILDING BASICS,** International Mountain Bicycling Association. This publication is available on-line at www.imba.com.

- **GENERAL GUIDELINES FOR IN-LINE SKATING TRAILS**, Rollerblade In-line Skate Association.

- **NATIONAL PARK SERVICE TRAILS MANAGEMENT HANDBOOK**, United States Department of the Interior, National Park Service: 1983.

- **MOTORIZED TRAILS: AN INTRODUCTION TO PLANNING AND DEVELOPMENT**, Pennsylvania Department of Environmental Resources, Bureau of State Parks: 1980.

- **IOWA SNOWMOBILE TRAIL MANUAL**, Iowa Department of Natural Resources: 1987.

- **FOREST RECREATION**, Robert W. Douglass: 1982.

- **AMC FIELD GUIDE TO TRAIL BUILDING AND MAINTENANCE**, Robert D. Proudman and Reuben Rajala, Appalachian Mountain Club: 1981.

- **A GUIDE TO OFF-ROAD MOTORCYCLE TRAIL DESIGN AND CONSTRUCTION**, American Motorcyclist Association: 1984.

TRAIL LOCATION AND PLACEMENT GUIDELINES

Trail location refers to the physical placement of the trail facility within a planned corridor. These guidelines are generally applicable to all types of trails.

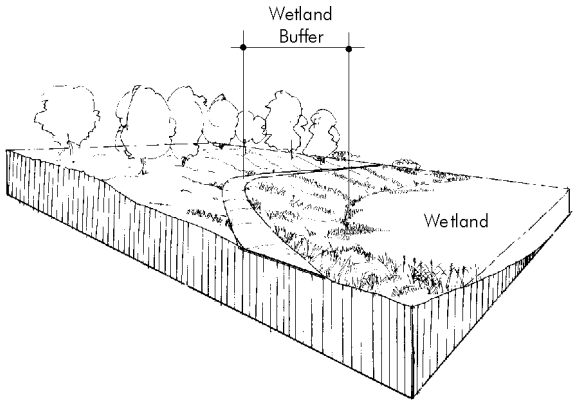
In many cases, especially within railroad corridors or road rights-of-way, placement is fairly well determined at the outset of the project. In such instances, the following guidelines are less applicable. Sometimes, however, there may be great flexibility in trail placement. For such trails, the following guidelines should act as a general overview of trail placement strategies. Final location for each trail project, however, must be determined based on the existing conditions, community desires, and cost constraints specific to the project.

—— SENSITIVITY TO NATURAL AND CULTURAL RESOURCES

A major desire of trail users is to be offered a scenic trail experience. In so doing, it is important that trails do not negatively impact the environment which they strive to showcase. The following guidelines describe how a trail's impact on natural and cultural resources could be reduced.

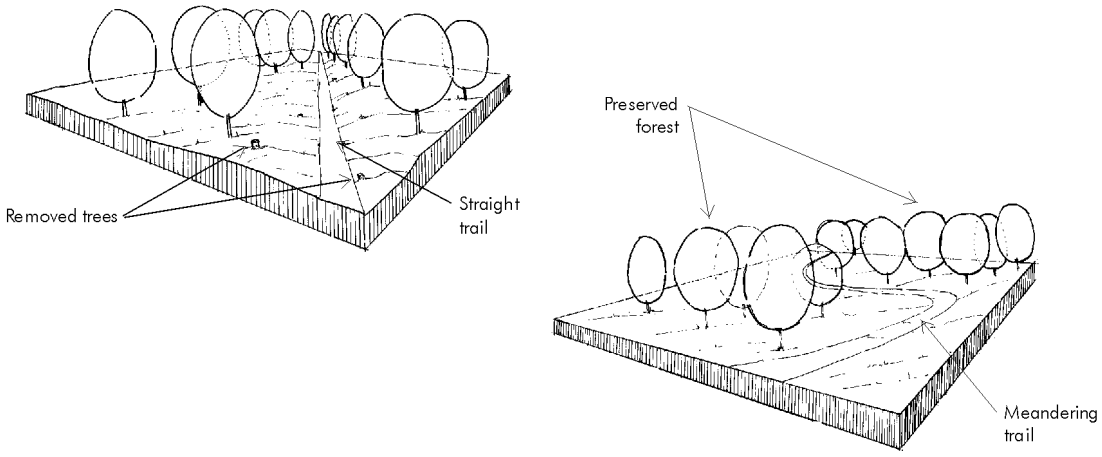
- Reduce grading on native grasslands and lakeshores.
- Avoid locating trails through wetlands. In cases where wetland crossings are necessary, a boardwalk or other structure may be used but would require a permit.
- Consider a buffer zone, planted with native vegetation, between trail and wetland, where possible (see Figure 4-1).

FIGURE 4-1: WETLAND BUFFER



- In forested areas, meander trail to avoid removal of trees, where possible (see Figure 4-2).

FIGURE 4-2: AVOIDANCE OF TREES IN A FORESTED AREA



- Consult with the Iowa Department of Natural Resources if endangered or threatened plant or animal species may be present in the trail corridor.
- Adhere to all applicable environmental regulations and reviews.
- Avoid locating trails through known archaeological sites.
- Consult with Iowa State Historic Preservation Office if cultural or historic resources exist within the corridor.

Trails Within Floodways

In some instances, wide river floodways are used as open space amenities by the communities that surround them. Other than a relatively short period of time in the spring, floodways are usable

recreational areas that may accommodate trails. It is important to understand, however, the seasonal changes in water level and volume when designing trails and any associated support services. Development of such recreational amenities may also fall under the regulation of any number of state or federal agencies, including the U.S. Army Corps of Engineers. These agencies will typically prohibit any filling in the floodplain.

The primary design issue associated with trails in floodways is trail surface. In natural areas, such as floodplain forest basins, natural surface trails are most appropriate. They will need yearly maintenance after the floodwaters recede, but they will not be seriously affected by flooding and will not adversely affect the environment. Care should be taken during yearly maintenance to restore the natural surface back to a firm and stable state that is accessible to all users. In urban floodways, hard-surfaced trails can provide important links in a community's trail system, and can accommodate a variety of users. Trails in floodways should never be surfaced with any type of aggregate, as the trail will easily wash away. Concrete or asphalt surfacing is preferred.

The following recommendations deal with trails in floodways:

- Adhere to all environmental regulations and reviews.
- Place trail at existing grade, to avoid the need for fill and to reduce disruptions to the floodway.
- In areas with regular flooding, provide a means of closing the trail during high water.
- Avoid the inclusion of support services within the floodway.

Scenic, Cultural, and Recreational Value

Trails should provide a high-quality recreational experience, they should be scenic, and they should offer opportunities for the interpretation of historic and cultural resources. The following guidelines describe strategies for capitalizing on the scenic and cultural value of trail corridors.

- Locate trails to pass through a variety of landscape types, where possible.
- Provide trail connections to scenic view points, cultural resource areas, recreational amenities, and support services where possible.
- Include interpretive signage at scenic view points and cultural resource sites that are accessible to all visitors, including people with vision impairments.

Adjacent Farmland

While productive agricultural land can be a scenic amenity for trail users, it is important to understand the value of that land to its owner. For trails that pass adjacent to active agricultural land, especially on abandoned railroad corridors, it is important to communicate with adjacent landowners during the trail planning process. Landowners' issues may include the need for trail crossings for farm machinery or animals, liability concerns, and concerns about vandalism and littering. The following guidelines describe methods for increasing a trail's compatibility with farmland.

- Work with adjacent landowners from the beginning of the trail planning process.

- Where trails will be located on abandoned railroad corridors, the trail owner should assume the responsibilities previously held by the railroad, such as drainage, weed and litter control, and fencing (see "Railroad Corridors" beginning on page 4-15).
- Where necessary, provide agricultural access across the trail for adjacent landowners (see "At-Grade Crossings" beginning on page 4-60).
- Where necessary, install a vegetative buffer or fence between the trail and adjacent property.
- Respect local setback requirements for adjacent commercial, industrial, and residential property.

Adjacent Commercial/Residential/Industrial Land

Within urban areas or rural towns, trails may pass near many different land uses. Trails can be a positive amenity for adjacent landowners, providing recreational opportunities to homeowners or employers, and connecting businesses to potential customers. A working relationship with adjacent landowners should be established at the beginning of the trail planning process. Many commercial property owners, depending on the type of business, will desire direct access to the trail. Bicycle rental/repair shops, campgrounds, lodging facilities, restaurants, snack shops, and other businesses can directly benefit from their proximity to the trail (see "Implementing Trail-Based Economic Development Programs," a special report of *Iowa Trails 2000*). Because these businesses offer positive amenities to trail users, access to them should be considered wherever possible.

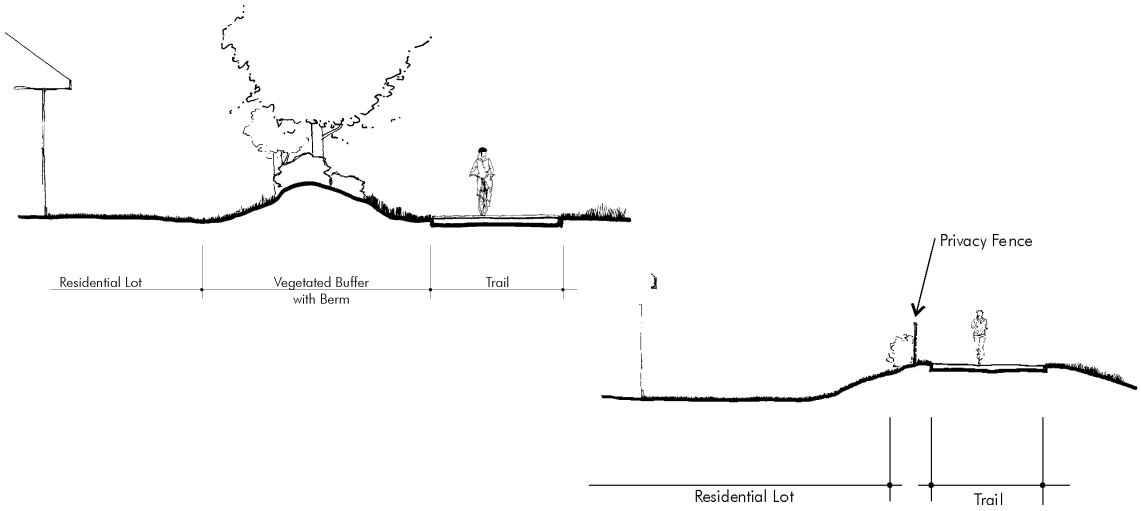
In some areas, commercial or industrial companies that do not provide direct services to trail users may also support trail development as a possible employee amenity. Trails may provide alternative commuting modes, and may also offer fitness and relaxation opportunities during the work day.

Residential neighborhoods may also benefit from trail access. People having direct access to a trail are more likely to use the trail for recreational and transportation purposes (see "Local Community Planning for Bicyclists and Pedestrians," a special report of *Iowa Trails 2000*).

The following guidelines apply to trails passing near commercial, residential, or industrial properties.

- Work with adjacent landowners from the beginning of the trail planning process.
- Where trails will be located on abandoned railroad corridors, the trail owner should assume the responsibilities previously held by the railroad, such as drainage, weed and litter control, and fencing (see "Railroad Corridors" on the next page).
- Where necessary, install a vegetative buffer or fence between the trail and adjacent property (see Figure 4-3).
- Plan for accessible trail connections to commercial areas.
- Consider dedicated connections within residential areas.

FIGURE 4-3: RESIDENTIAL TRAIL BUFFERS



Resources: "Implementing Trail-Based Economic Development Programs," *Iowa Trails 2000*.

"Local Community Planning for Bicyclists and Pedestrians," *Iowa Trails 2000*.

——*Railroad Corridors*

Iowa has historically been a pioneer in utilizing abandoned railroad corridors for trail projects. These corridors are ideal for trail users, especially people with mobility impairments and older adults because they offer continuous, nearly flat routes. However, because the trails are often located on elevated rail beds, care must be taken to develop accessible pathways to all trailheads and access points.

Railroad corridors also offer the advantage of a continuous right of way under single ownership. Trails can replace or join railroads without taking any new land out of production. To assemble this type

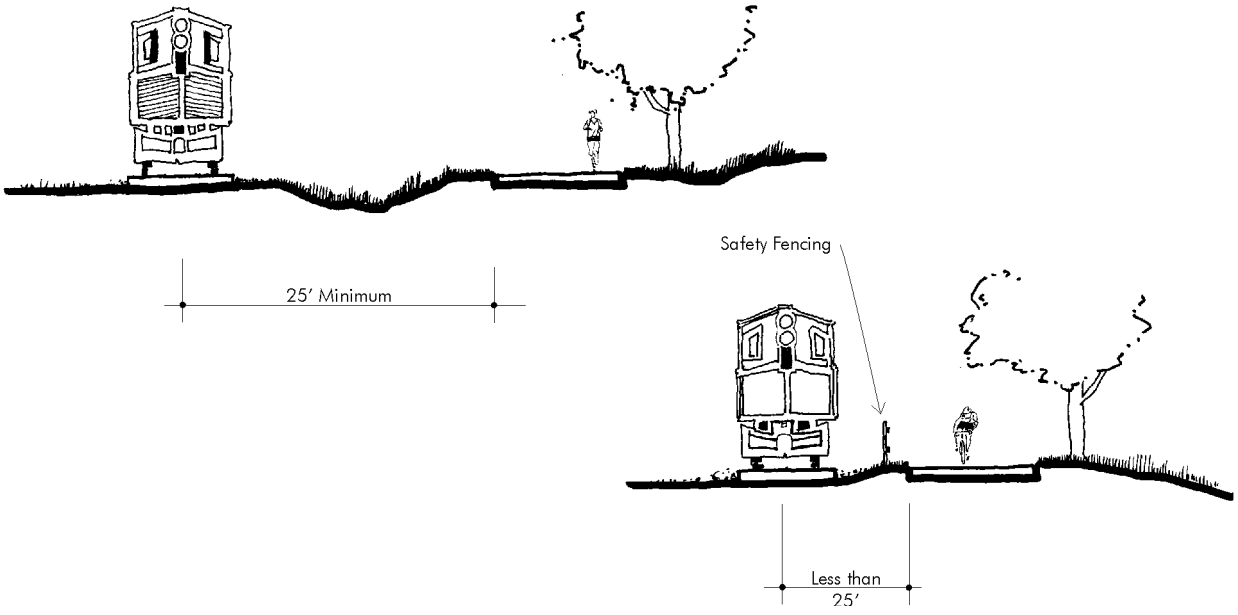
of corridor piecemeal would be nearly impossible, and prohibitively expensive. Conversion of abandoned railroad corridors to trails has caused some controversy, however, primarily from adjacent landowners. When a trail is implemented on an abandoned railroad corridor, the trail owner must assume the responsibility and liability of the railroad, as provided by the Iowa Code, and should establish a working relationship with landowners along the corridor. The following guidelines apply to trail projects located on abandoned railroad corridors.

- Work with adjacent landowners from the beginning of the trail planning process.
- The trail owner should keep the corridor free of weeds, especially invasive species that could impact adjacent crops.
- The trail owner should assume responsibility for drainage of the trail, ensuring that water does not divert onto adjacent property. Because a railroad corridor's surface is mostly permeable, paving the surface will cause an increase in runoff. Adequate drainage of the trail is necessary.
- The trail owner should provide appropriate support services along the trail (see "Support Services" beginning on page 4-77).
- Where necessary, provide agricultural access across the trail for adjacent landowners (see "At-Grade Crossings" beginning on page 4-60).
- Where necessary, install a vegetative buffer or fence between the trail and adjacent property.
- Liability issues should be clearly articulated prior to trail implementation.

In limited cases, trails may be implemented in railroad corridors that are still active. This may occur where the right-of-way is wide or where train traffic is infrequent or travels at low speeds. This "rail-with-trail" method can be employed when a two- or three-track mainline eliminates one track but maintains its full right-of-way width. This type of trail facility requires extensive cooperation with the railroad. The following guidelines apply to trails implemented within active rail corridors.

- The edge of the trail should be at least 25 feet from the centerline of the active tracks (see Figure 4-4).
- If a trail passes closer to the active track than 25 feet, fencing should be installed at the edge of the trail (see Figure 4-4).

FIGURE 4-4: RAILROAD BUFFERS



Resources: "Planning and Designing Rail-Trails on Abandoned Rail Lines," Road Management and Engineering Journal, TranSafety, Inc.: 1997.

"Rails With Trails," Rails-to-Trails Conservancy.

ROAD RIGHTS-OF-WAY

Trails located within road rights-of-way can be an effective transportation and recreation amenity for a variety of trail-related uses. They offer ease of navigation, connection to existing support facilities, and right-of-way that is already publicly owned. The Iowa Department of Transportation, in 1999, set forth a guidance on bicycle and pedestrian accommodations within Iowa's primary road system. The guidance states that the Iowa DOT will consider bicycle accommodations in highway construction projects and encourages city and county jurisdictions to do the same. The department will also consider impacts to pedestrian facilities resulting from roadway reconstruction. Possible bicycle facilities include paved shoulders, wide curb lanes, bicycle lanes, and separated bicycle paths (see "Trail Design Guidelines" beginning on page 4-20). The guidance states that Iowa DOT will use the AASHTO Guide for the Development of Bicycle Facilities and FHWA's Selecting Design Treatments to Accommodate Bicycles (both referenced above) as primary guidelines for facility design. Criteria for determining the need to accommodate bicycle facilities within highway corridors were developed as part of *Iowa Trails 2000*. These criteria are included in Appendix C. Examples of conditions that could warrant further bicycle accommodation within a highway corridor include the following:

- When highways are the primary means of bicycle transportation, due to the lack of other facilities.
- When the highway is the primary access to a park, recreation area, or other significant destination.
- When the highway provides unique access across a natural or man-made barrier.

- When the highway exists as a link in an otherwise continuous bicycle facility.
- When the highway project would negatively affect the recreation or transportation utility of an independent bicycle facility.

When highway construction projects occur, and any of these criteria are met, local communities and the Iowa DOT staff should work together to review the need to implement bicycle facilities in the highway corridor.

The implementation of bicycle facilities within road rights-of-way may conflict with existing snowmobile trails. Planners should make themselves aware of snowmobile trails and design additional facilities to reduce conflicts.

Resources: "Highway Planning and Programming Guidance," Iowa Department of Transportation: May 28, 1999.

Iowa DOT Design Manual.

— *Utility Corridors*

Continuous utility corridors can be good opportunities for trail implementation in rural areas. Utility corridors, typically overhead electric or telephone lines, offer linear rights-of-way that see little active use. Many of the issues here are the same as those covered under "Adjacent Farmland" beginning on page 4-12 above. It is important to recognize that the best utility corridors are those that are owned outright by the utility company, as opposed to corridors that hold easements over agricultural land. Coordination with the utility is crucial

to the implementation of this type of trail. The following guidelines apply to trail facilities in utility corridors.

- Work with adjacent landowners from the beginning of the trail planning process.
- Where necessary, provide agricultural access across the trail for adjacent landowners (see "At-Grade Crossings" beginning on page 4-60).
- Where necessary, install a vegetative buffer or fence between the trail and adjacent property.
- Locate trail so that impact to utility poles and other above-ground elements is minimized.
- The trail owner may need to assist the utility in providing fencing or barricades to protect above-ground utility structures, such as towers, and control boxes.
- An agreement between the trail owner and the utility will be required to address trail restoration and cost responsibility for trail damage due to utility maintenance.

TRAIL DESIGN GUIDELINES: USE MODES

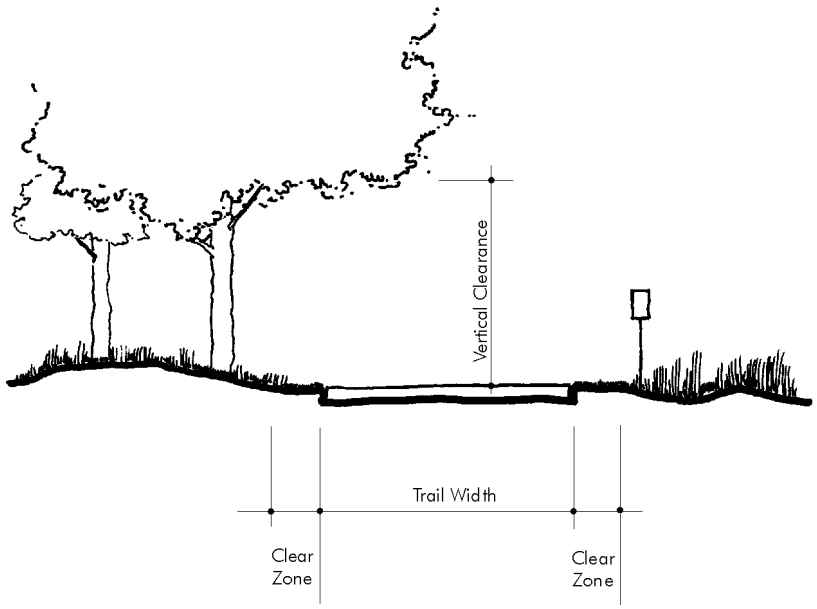
While it is most common for use modes to be combined on trails or within corridors, Iowa *Trails 2000* discusses each mode to ensure that the needs of various users are thoroughly considered. When combining use modes, the guidelines for each mode should be consulted and the most stringent should be used (see "Multi-Use Corridors" beginning on page 4-54). The modes considered include hiking/walking, bicycling, in-line skating, equestrian, snowmobiling, off-highway vehicles (OHVs), and motorcycles (canoe trail designation is covered beginning on page 4-83). Each of these use modes is described below, and guidelines are set forth relating to the following design considerations.

- **CLEAR TRAIL WIDTH** refers to the width of the traveled part of the trail that is free of protruding objects and obstacles, such as trees and overgrown vegetation (see Figure 4-5).

- **CLEAR ZONES** refer to the area on each side of the trail between the traveled surface and any obstructions, such as trees, walls, or fences (see Figure 4-5).

- **VERTICAL CLEARANCE** refers to the height above the trail which is free from protruding objects and overhead obstructions, such as tree branches or bridges (see Figure 4-5).

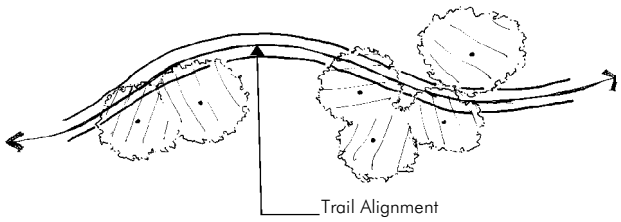
FIGURE 4-5: TRAIL DIMENSIONS



- **TRAIL SURFACE** refers to the type of surface on the traveled part of the trail, such as asphalt, concrete, granular, or alternative. Surface quality is affected by tread obstacles, such as roots or rocks, and by any openings such as gaps and grates located within the trail surface.

- **DRAINAGE** refers to techniques used to move and keep water off the trail and trail embankment.

- **ALIGNMENT** refers to the horizontal curvature of the trail.



- **PROFILE** refers to the vertical curvature of the trail.

- **EDGE PROTECTION** refers to any protective barrier designed to separate the trail from its surrounding environment, such as a fence or curb. As a general rule, curbs should not be less than 4 inches in height. Other types of edge protection are discussed, where appropriate, under each trail mode.

At-grade crossings, grade-separated crossings, multi-use corridors, support services, striping, and signage will be covered in later sections.

These design guidelines are meant as general recommendations. Many of the design considerations listed above will be impacted by local conditions, such as topography, right-of-way width, and intensity of use. Each trail project is unique, and while these guidelines should be employed wherever possible, deviations may occur.

—— *Hiking/Walking Trails*

Pedestrian facilities can take several forms. Hiking/walking trails, sidewalks (see page 4-29), and pedestrian trails (see page 4-26) provide different user experiences for pedestrians.

Hiking/walking trails, covered in this section, are facilities used exclusively by pedestrians, and are typically found in natural areas. They offer a low-impact means of allowing pedestrians to come in contact with the natural environment. Hiking/walking trails are used by a variety of people with a broad range of abilities, skill levels, and desired experiences, and should be designed to accommodate all persons. New and reconstructed trails should be made as accessible as possible while maintaining the essential character of the resource. Furthermore, all trail amenities, such as restrooms, drinking fountains, and picnic tables should comply with the ADA accessibility guidelines. Because of their rustic nature, the guidelines for hiking/walking trails are very general, and trail design will be primarily determined by site conditions.

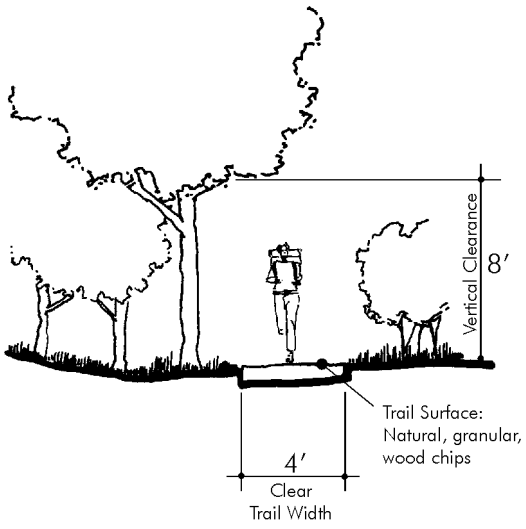
Clear Trail Width

- ◇ Recommended clear trail width for hiking/walking trails: 4 feet (this may be reduced based on site conditions and desired trail experience) (see Figure 4-6).
- ◇ Hiking/walking trails should include widened areas at regular intervals to allow users to pass one another. These widened areas should be at least 5 feet by 5 feet.
- ◇ In urban or suburban locations, hiking/walking trails should be set back at least 5 feet from any roadway curb.

Clear Zones

Hiking/walking trails do not typically require clear zones, since users are moving at relatively slow speeds. In natural areas, underbrush should be trimmed so that it does not hang over the trail edge or obstruct the traveled way.

FIGURE 4-6: TRAIL DIMENSIONS FOR HIKING/WALKING TRAILS



Vertical Clearance

◇ Hiking/walking trails should maintain an 8-foot minimum vertical clearance (see Figure 4-6). If the hiking/walking trail is used by cross-country skiers during the winter months, the average snow level should be added to the 8-foot minimum.

Trail Surface

◇ Hiking/walking trails may be surfaced with wood chips or crushed stone, or may be made of compacted earth. In any case, the surface should be firm and stable. It should be noted, however, that wood chips are not considered an accessible surface.

◇ In wet areas a boardwalk is recommended (see "Wetland Boardwalks" beginning on page 4-75).

◇ Any tread obstacles, such as rocks or roots, imbedded into the trail surface should be less than 2 inches.

◇ Any openings within the trail surface, including on bridges, should not permit passage of a 0.5-inch diameter sphere and should be perpendicular to the dominant direction of travel.

Drainage

Because users of a hiking/walking trail will come in direct contact with the trail surface, drainage is very important. Natural surface trails can become watercourses during heavy rains, causing severe erosion. The following methods effectively move water off the trail.

- ◇ In flat areas, the trail should be cross-sloped or crowned at approximately 2 percent.
- ◇ Where a trail is benched into a slope, a swale on the uphill side should be considered to catch water before it crosses the trail.
- ◇ Culverts may be necessary to move water under the trail.
- ◇ Disturbed areas should be seeded and mulched or sodded to prevent erosion.

Alignment

Users of hiking/walking trails can navigate even the tightest of turns. Alignment guidelines are not necessary for hiking/walking trails.

Profile

It is recommended that no more than one-third of the total trail length for a hiking/walking trail exceed 8.3 percent. In addition, the following guidelines should be followed:

- ◇ Trail grade may be 5 percent or less for any distance.
- ◇ Trail grade may be 8.3 percent for a maximum distance of 200 feet.
- ◇ Trail grade may be 10 percent for a maximum distance of 30 feet.
- ◇ Trail grade may be 12.5 percent for a maximum distance of 10 feet.

The trail grade between the maximum grade segments should return to 5 percent for a minimum distance of 5 feet to allow resting opportunities for people who have difficulty traveling over sloped surfaces.

If, due to local topography, the trail would be steeper than the above recommendations permit, switchbacks should be used to lessen the overall slope.

Edge protection

Edge protection is not required on a hiking/walking trail; however, if provided it should be at least 4 inches. Pedestrians with vision impairments tend to adjust their obstacle detection to a slightly higher level on hiking/walking trails because of all the small obstacles contained within a natural trail surface. Edge protection that is at least 4 inches high is much more likely to be detected.

Pedestrian Trails

Pedestrians are typically accommodated with other trail users such as bicyclists and in-line skaters, within a multi-use corridor. In some cases, however, pedestrians may be accommodated on an exclusive trail, as a means of separating pedestrians from faster moving bicyclists and in-line skaters.

Where pedestrian use is expected, facilities should be accessible to a variety of people with a broad range of abilities, skill levels, and desired experiences, and should be designed to accommodate all persons. New and reconstructed trails should be made as accessible

as possible while maintaining the essential character of the resource. Furthermore, all trail amenities, such as restrooms, drinking fountains, and picnic tables, should comply with the ADA accessibility guidelines.

Pedestrian trails, unlike hiking/walking trails, are designed for a more formalized trail experience. Whereas hiking/walking trails may be quite rugged, pedestrian trails are typically designed for more leisurely walking on finished surfaces.

Clear Trail Width

◇ Recommended width for pedestrian trails: 5 feet.

Clear Zones

Because of the relatively slow speed of pedestrians, clear zones are not necessary.

Vertical Clearance

◇ Pedestrian trails should maintain an 8-foot minimum clearance. If the hiking/walking trail is used by cross-country skiers during the winter months, the average snow level should be added to the 8-foot minimum.

Trail Surface

Pedestrian trails, as discussed above, will almost always exist in conjunction with non-motorized multi-use trails. Their surface, therefore, should be the same as that used for the adjacent multi-use trail. Where pedestrian trails occur alone, they may be asphalt, concrete, or granular. Whenever possible, the surface of a pedestrian

trail should be smooth and free of tread obstacles. Any openings imbedded into the trail surface should not permit passage of a 0.5-inch diameter sphere and should be perpendicular to the dominant direction of travel.

Drainage

◇ Pedestrian trails should have a 2 percent cross-slope.

Alignment

Users of pedestrian trails can navigate even the tightest of turns. Alignment guidelines are not necessary for pedestrian trails.

Profile

It is recommended that no more than one-third of the total trail length for a pedestrian trail exceed 8.3 percent. In addition, the following guidelines should be followed:

◇ Trail grade may be 5 percent or less for any distance.
◇ Trail grade may be 8.3 percent for a maximum distance of 200 feet.
◇ Trail grade may be 10 percent for a maximum distance of 30 feet.
◇ Trail grade may be 12.5 percent for a maximum distance of 10 feet.

The trail grade between the maximum grade segments should return to 5 percent for a minimum distance of 5 feet to allow resting opportunities for people who have difficulty traveling over sloped surfaces.

Edge protection

Edge protection is not required on a pedestrian trail; however, if provided it should be at least 4 inches.

Sidewalks

Sidewalks are pedestrian facilities primarily used in cities and towns. They are typically designed for pedestrians only, and should not be used by bicyclists. Sidewalks typically offer pedestrian connections within a community, and are, therefore, an important component of local pedestrian planning. Guidelines for this type of facility are found in the handbook "Local Community Planning for Bicyclists and Pedestrians," (*Iowa Trails 2000*).

Bicycle Trails

There are extensive guidelines that have been established for bicycle facilities. Bicycles, however, are unlikely to ever enjoy exclusive use of a trail facility. In most cases, bicycle trails will also accommodate pedestrians and in-line skaters on a single paved treadway.

Because bicycles typically travel at higher speeds than pedestrians, trail geometrics are a major consideration. The AASHTO Guide is an invaluable resource when designing bicycle trails. The guide gives detailed information on alignment and profile layout and design.

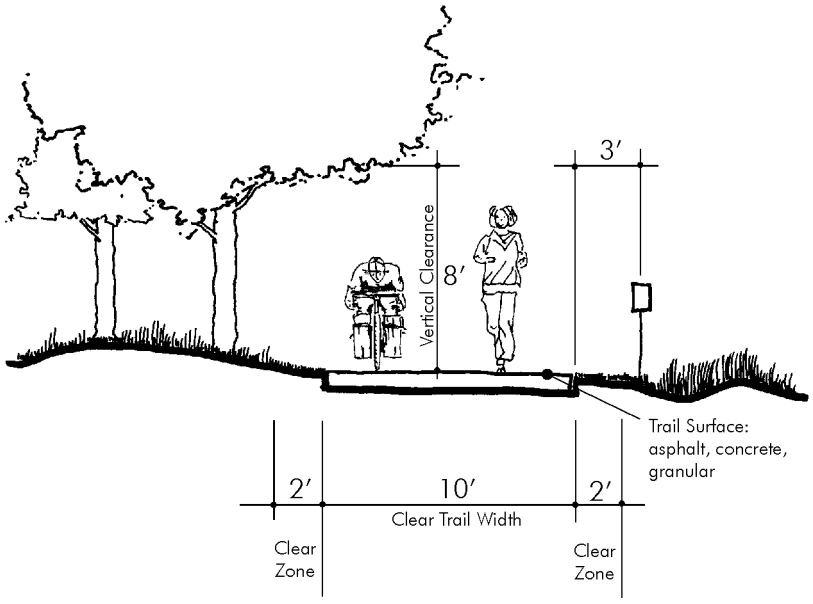
Clear Trail Width

- ◇ Recommended width for two-way bicycle trail: 10 feet (may be increased to 12 feet depending trail traffic) (see Figure 4-7).
- ◇ Recommended width for one-way bicycle trail: 6 feet (Separated one-way trails in the same corridor should have a minimum 2-foot median between them).

Clear Zones

- ◇ Bicycle trails should maintain a minimum 2-foot graded area on each side of the trail, graded at a maximum slope of 6:1 (see Figure 4-7).
- ◇ Bicycle trails should maintain a minimum 1-foot buffer zone between the edge of the graded clear zone and any fixed objects such as signs or trees. On bridges this guideline does not apply (see Figure 4-7).

FIGURE 4-7: TRAIL DIMENSIONS FOR BICYCLE TRAILS



Vertical Clearance

Bicycle trails should maintain an 8-foot minimum vertical clearance (see Figure 4-7).

Trail Surface

◇ Asphalt or concrete are the preferred surfaces for bicycle trails.

The surface of a bicycle trail should be smooth and free of tread obstacles. In some cases, granular surfacing may be used as an interim solution. Granular trails can be difficult to maintain, and can be harder on bicycles than paved trails. In addition, granular surfacing eliminates use of the trail by in-line skaters. Any decision to use granular surfacing for bicycle trails should be carefully evaluated.

Drainage

It is very important that bicycle trails are well drained. Standing water on the trail will adversely affect the trail surface and decrease the life and quality of the trail.

◇ Bicycle trails should not exceed a uniform cross slope of 2 percent (see Figure 4-8). Crowning of the trail at 2 to 3 percent is acceptable, but may be more difficult and costly to construct (see Figure 4-9).

◇ Where a trail is benched into a slope, a swale on the uphill side should be considered to catch water before it crosses the trail (see Figure 4-10).

◇ Culverts may be necessary to move water under the trail.

◇ Disturbed areas should be seeded and mulched or sodded to prevent erosion.

FIGURE 4-8: TRAIL CROSS SLOPE

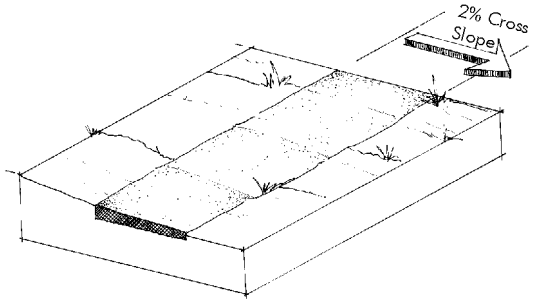


FIGURE 4-9: CROWNING OF A TRAIL

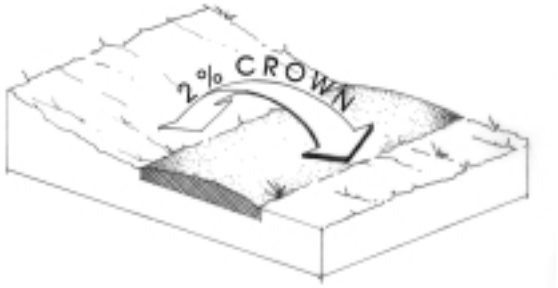
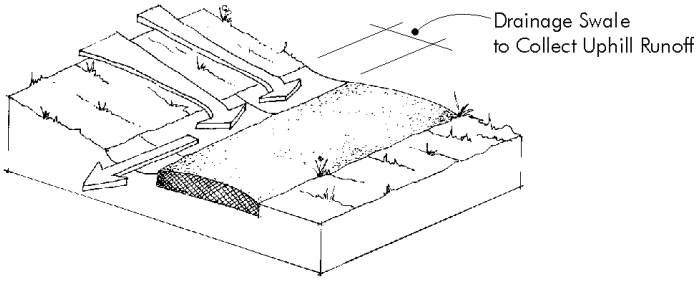


FIGURE 4-10: TRAIL WITH DRAINAGE SWALE



Alignment

The design of bicycle trail alignment can be as complex as roadway design. Many factors must be taken into consideration, including design speed, the surface type, and sight lines. The AASHTO Guide and "Minnesota Bicycle Transportation Planning and Design Guidelines" offer detailed information on alignment and superelevation. In general, a typical curve radius for a bicycle trail will be approximately 100 feet.

Another issue to consider when designing a trail's alignment is visibility on horizontal curves, which is based on stopping sight distance. Stopping sight distance refers to the amount of time it would take a user to stop once an obstruction has come into view. As a general rule, the distance a user can see along the trail should never be less than the distance it would take that user to stop. Procedures for determining stopping sight distance are detailed in the AASHTO Guide and should be applied to both alignment and profile.

Profile

The profile of a bicycle trail is also a major consideration which requires detailed analysis and design. Issues to consider when designing a trail's profile include steepness (or overall grade of the trail) and stopping sight distance (discussed above). The following recommendations are for general planning purposes only. Final trail design requires more detailed analysis based primarily on the AASHTO Guide.

- ◇ Maximum recommended grade for bicycle trails: 5 percent.
- ◇ Grades on bicycle trails steeper than 5 percent are possible, but should be restricted to distances as indicated in the AASHTO Guide.

Stopping sight distance applies to vertical curves (hills) just as it does to horizontal curves. This consideration is especially important on downhill sections, as speeds will be higher. As described above, the AASHTO Guide is an invaluable resource for detailed trail design, and should be consulted during the final design process.

Edge Protection

Edge protection, typically in the form of fencing, is required on bicycle trails only in areas where safety is a concern. Such safety considerations should be evaluated in detail during the final design of the trail. If fencing is provided, it should be at least 42 inches high. Some possible situations where fencing might be warranted include:

- ◇ Locations where the land on either side of the trail drops off steeply.
- ◇ Locations where sharp curves may cause users to lose control and leave the trail.
- ◇ Locations where adjacent uses, such as railroad tracks or active industry, may cause a threat to trail user safety.
- ◇ Bridges (see "Grade-Separated Crossings" beginning on page 4-70).

Where fencing is included, rub-rails should be installed for the safety of bicyclists and wheelchair users. Rub-rails should be installed at ground level and at the general level of an adult bicyclist's handlebars.

—— *In-Line Skating Trails*

In-line skaters are typically accommodated along with other modes. They will be commonly found along with bicyclists and pedestrians on multi-use trails. In-line skating trails, therefore, can use the standards described for bicycle trails (see "Bicycle Trails" beginning on page 4-29).

—— *On-Road Bicycle Facilities*

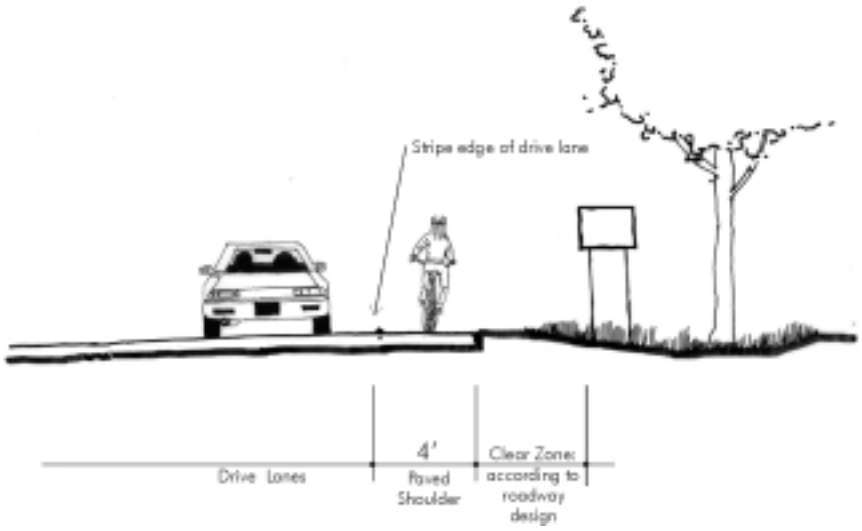
There is extensive literature relating to guidelines for on-road bicycle facilities. AASHTO and FHWA, as well as many states, offer a wide range of guidelines for various types of bicycle accommodations. There are essentially three types of on-road bicycle facilities: paved shoulders, shared roadways (including wide curb lanes), and bicycle lanes. All on-road bicycle facilities should be designed so bicyclists travel in the same direction as motorists.

Safety is of great concern in the design of on-road bicycle facilities. Conflicts with pedestrians, automobiles, or other bicyclists can lead to serious injury. Poorly maintained pavement, snow build-up and debris can also lead to safety problems. The guidelines listed below are minimum recommendations only, and site-specific conditions may dictate variations for safety purposes.

Clear Trail Width

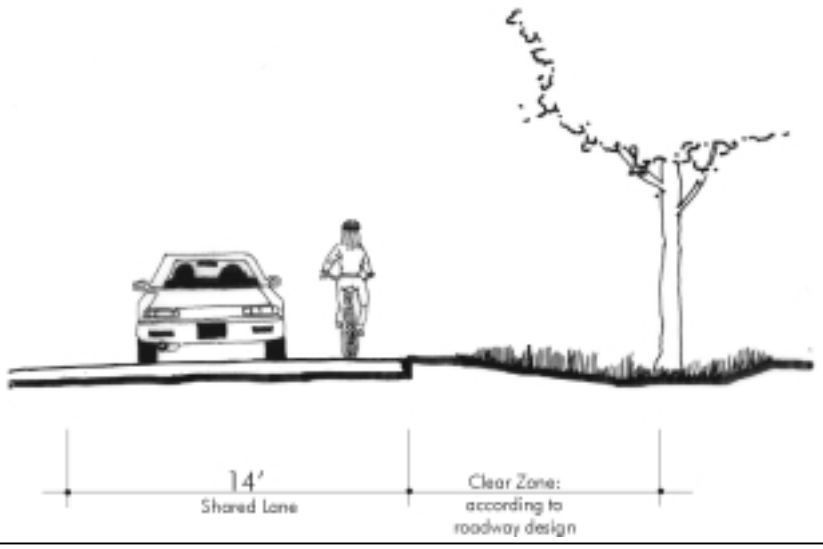
◇ Paved shoulders: minimum 4 feet, to accommodate bicycle use, but refer to AASHTO's "A Policy on Geometric Design of Highways and Streets (Green Book)" and FHWA's "Selecting Roadway Design Treatments to Accommodate Bicycles" for recommendations for greater shoulder width, which is desirable where shoulders provide multiple benefits and where motor vehicle speeds exceed 50 miles per hour (see Figure 4-11).

FIGURE 4-11: PAVED SHOULDER DIMENSIONS



- ◇ Paved shoulders adjacent to guardrails or other roadside barriers: 5 feet.
- ◇ Widened curb lanes: 14 feet of usable lane width (see Figure 4-12).
- ◇ Widened curb lanes on steep uphill segments: 15 feet (continuous wide lanes greater than 15 feet are not recommended, as motor vehicles may use them as two lanes).

FIGURE 4-12: SHARED LANE DIMENSIONS



◇ Minimum width of bicycle lanes: 4 feet as measured from edge of roadway, or 5 feet as measured from the face of the curb or a guardrail to the bicycle lane stripe (see Figure 4-13).

◇ Desirable width of bicycle lanes: 5 feet as measured from edge of roadway.

◇ Minimum width of bicycle lanes adjacent to parking: 5 feet (see Figure 4-14).

FIGURE 4-13: BICYCLE LANE DIMENSIONS

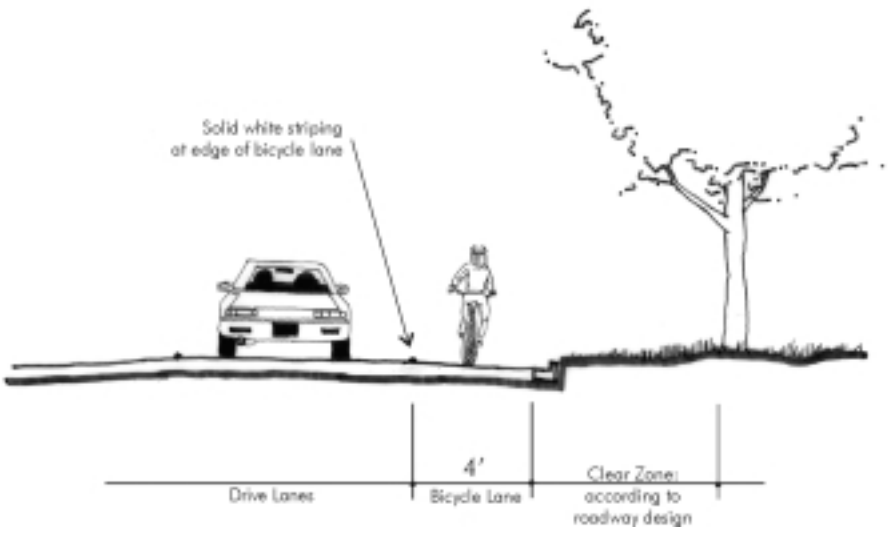
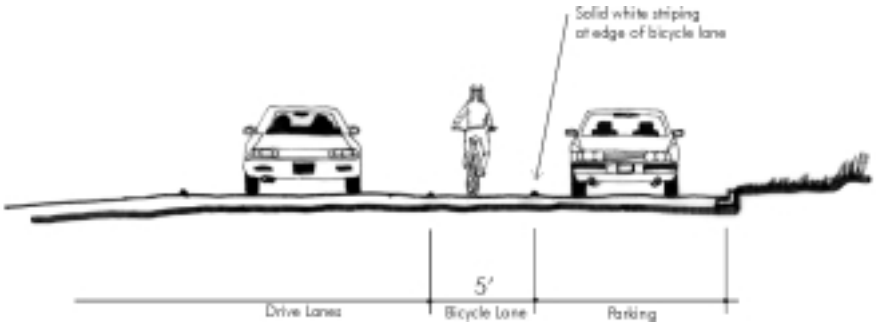


FIGURE 4-14: BICYCLE LANE DIMENSIONS
ADJACENT TO PARKING



One issue that may impact on-road bicycle facilities is the presence of rumble strips. Occasionally used on roadways with rural sections, they will lessen the usable width of an on-road bicycle facility. Rumble strips "…are not recommended where shoulders are used by bicyclists unless there is a minimum clear path of 1 foot from the rumble strip to the traveled way, 4 feet from the rumble strip to the outside edge of paved shoulder, or 5 feet to adjacent guardrail, curb or other obstacle." (AASHTO Guide, 1999).

Clear Zones, Vertical Clearance, Trail Surface, Alignment, Profile, and Edge Protection

On-road bicycle facilities will normally benefit from design standards required by the roadway itself. Such requirements are sufficient for the bicycle facility. On-road bicycle facilities should only be designated on hard-surfaced roadways.

Drainage

The primary drainage issue to consider regarding on-road bicycle facilities is the existence of roadway drain inlets. Some types of inlet grates may trap a bicycle wheel or send the rider off course. Bicycle-compatible inlets are widely available, and these should be used on all roadways where bicyclists are expected. On rural sections, the cross-slope required by roadway construction is adequate to drain the bicycle facility.

—— *Mountain Bike Trails*

Mountain bike trails are typically rugged, off-road facilities. They have far less stringent guidelines than non-motorized multi-use trails, but can accommodate only one type of bicycle. The hallmark of mountain bike trails is the "single track," which is a narrow pathway with many hills and sharp turns. Such facilities can vary greatly in difficulty.

Recently, there has been a surge of people who recreate in off-road wheelchairs that are designed similarly to mountain bikes. However, not every mountain biking trail will accommodate the additional width of off road wheelchairs (approximately 28 to 34 inches). Therefore, trail designers should post objective information about the minimum clear width of the trail, so people who use off road wheelchairs can make informed recreation decisions.

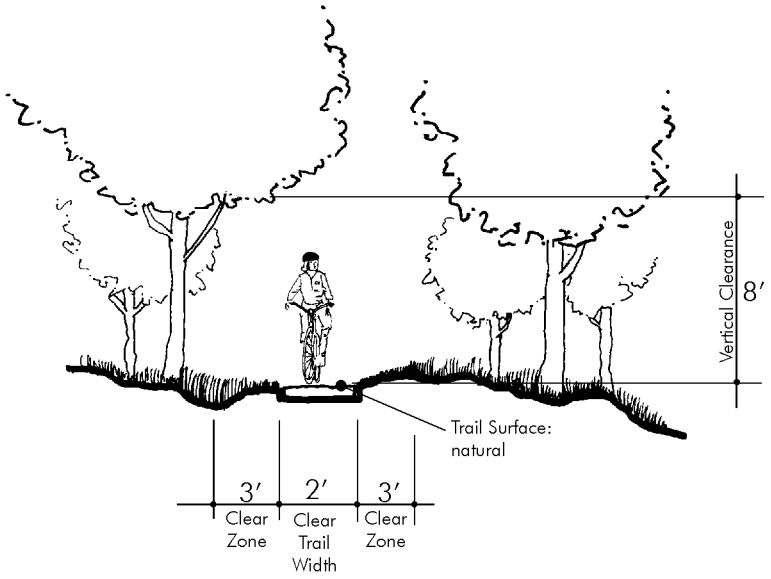
Clear Trail Width

◇ Desirable width for mountain bike trails: 2 feet (see Figure 4-15).

Clear Zones

◇ Shrubby vegetation should be removed to a distance of 3 feet on each side of the tread. Established trees and grasses may remain (see Figure 4-15).

FIGURE 4-15: TRAIL DIMENSIONS FOR MOUNTAIN BIKE TRAILS



Vertical Clearance

◇ Mountain bike trails should maintain an 8-foot minimum clearance (see Figure 4-15).

Trail Surface

◇ Preferred surface for mountain bike trails: compacted earth.

Drainage

Without proper drainage, mountain bike trails may become severely eroded. Several options exist for properly draining mountain bike trails.

◇ Mountain bike trails should be cross-sloped at 3 to 5 percent.

◇ Flexible waterbars or swales should be used to remove water from trails.

◇ Special consideration should be given to placement of trails.

Alignment

Alignment of mountain bike trails will primarily depend on the difficulty of the trail to be constructed. In general, the tighter the turn, the more challenging a trail may become.

Profile

◇ Maximum overall grade for mountain bike trails: 10 percent. This level of steepness will allow minor increases or decreases in slope to avoid obstacles. Dips and inclines should be built into the trail to provide interest and facilitate drainage.

Edge Protection

Edge protection is not usually required for mountain bike trails. In areas where safety is of great concern, fences with a minimum height of 42 inches should be installed.

Equestrian Trails

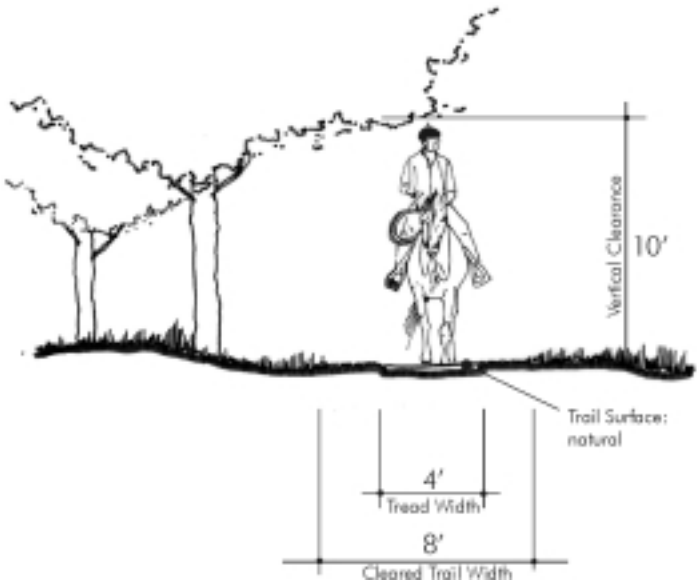
Trails designed to accommodate horses have a great deal of flexibility in design. The most important consideration for equestrian trails is the surface, which should be designed to reduce injuries to animals and riders. The placement of obstacles is also a key issue for designing equestrian trails. Some people with mobility impairments are able to travel by horseback but are not able to walk a horse around obstructions. Therefore, equestrian trails should not require the rider to dismount to avoid obstacles while on the trail. In all design elements, the safety of the horse and rider is paramount.

Clear Trail Width

- ◇ Desirable tread width for equestrian trails: 4 feet (see Figure 4-16).
- ◇ Desirable cleared trail width for equestrian trails: 8 feet (see Figure 4-16).

Tread width refers to the actual traveled surface of the trail. Cleared trail width refers to the areas where underbrush, branches, and other obstructions have been removed. In most cases, there will be little difference between the two, as riders will use the entire cleared area, especially when passing in opposite directions.

FIGURE 4-16: TRAIL DIMENSIONS FOR EQUESTRIAN TRAILS



CLEAR ZONES

The cleared trail width listed above includes adequate clear zones for equestrian use.

VERTICAL CLEARANCE

◇ Equestrian trails should maintain a minimum vertical clearance of 10 feet (see Figure 4-16).

TRAIL SURFACE

◇ Equestrian trails should have a surface of uncompacted natural material.

◇ Equestrian trails should be free from brush, stumps, logs, large rocks, and other obstructions that may injure horses.

Drainage

Areas where standing water is likely should be drained by sloping the trail or installing ditches.

Alignment

Horses can maneuver almost any corner, and can travel at low speeds. Therefore, no alignment guidelines are necessary for equestrian trails.

Profile

Because equestrian trails are used by animals carrying a significant amount of weight, trail grade is an important consideration.

- ◇ Maximum grade for equestrian trails: 10 percent.
- ◇ Maximum grade for shorter slopes (100 feet) on equestrian trails: 20 percent.
- ◇ Switchbacks should be used for surmounting slopes greater than the above parameters.

Edge Protection

Edge protection is not usually required for equestrian trails. In areas where safety is of great concern, fences should be installed.

——*Snowmobile Trails*

Snowmobile trails are unique among the trail modes considered in *Iowa Trails 2000* because their use will only take place in winter. This seasonal dependency necessitates some unique design considerations.

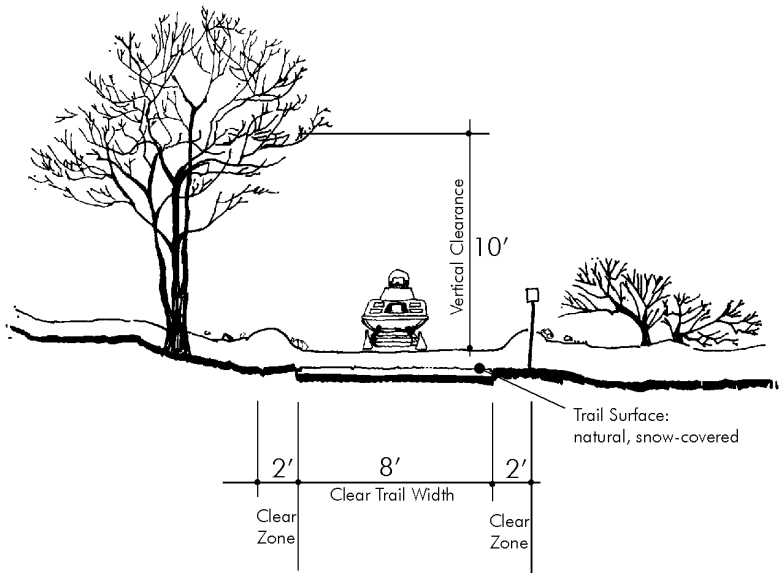
In addition, snowmobiles are capable of high speeds, increasing the need for safety through trail design. As with all motorized trails, signing should be used to warn non-motorized users of the predominate use mode. In some situations clearly indicated dual trails can be indicated for the safe sharing of a corridor by motorized and non-motorized users.

Clear Trail Width

- ◇ Desirable groomed surface for one-way snowmobile trails: 8 feet (see Figure 4-17).
- ◇ Desirable groomed surface for two-way snowmobile trails: 10 feet.
- ◇ At sharp corners or unusually rugged terrain, the trail should be widened to accommodate grooming equipment and provide user safety.

The groomed surface refers to the area which is free from branches, large rocks, brush, stumps, and other obstructions that would create an uneven and unsafe surface even when the trail is covered with snow.

FIGURE 4-17: TRAIL DIMENSIONS FOR SNOWMOBILE TRAILS



Clear Zones

◇ Snowmobile trails should maintain a 2-foot clear zone on each side of the groomed surface (see Figure 4-17).

Vertical Clearance

◇ Snowmobile trails should maintain at least 10 feet of vertical clearance above the average snow level to accommodate grooming equipment (see Figure 4-17).

Trail Surface

Many snowmobile trails are enjoyed by other trail users during the summer months. In these situations, the surface should be designed according to the needs of the additional user. If the trail is not used during the summer, a variety of surfaces are possible because the trail will be buried with snow for snowmobile use. The surface should be relatively flat and free from obstructions as listed above.

◇ Snowmobile trails may exist on an otherwise unprepared surface, provided that stumps, brush, and other obstructions are removed. Snowmobile trails within road rights-of-way demonstrate this type of surface.

◇ Snowmobile trails may exist on crushed stone surfacing.

◇ Snowmobile trails may exist on wooden bridges or boardwalks when crossing watercourses or wetlands.

◇ Placement of snowmobile trails on asphalt surfaces should be avoided, as studs will cause damage to the asphalt. When implementing a snowmobile trail along with an asphalt trail, a natural surface corridor should be provided and clearly marked for snowmobile use.

Alignment

- ◇ Minimum forward visibility for snowmobile trails: 50 feet.
- ◇ Minimum radius for snowmobile trail curves: 25 feet.
- ◇ Where hazards exist (such as a steep drop-off) near a curve, the trail should be superelevated.

Profile

- ◇ Maximum slope for snowmobile trails: 12 percent.
- ◇ Maximum grade for shorter slopes (100 feet) on snowmobile trails: 25 percent.
- ◇ Snowmobile trails should ascend steep slopes at right angles to the contour lines (directly up the fall line). Ascending such slopes at angles could cause sliding of snowmobiles and slope erosion.

Edge Protection

Edge protection is not usually required for snowmobile trails. In areas where safety is of great concern, fences should be installed.

Other Points to Consider

- ◇ Water crossings: Even though ice may be in place for much of the snowmobiling season, water crossings without bridges are not acceptable as part of a snowmobile trail.
- ◇ Exposure: In order to extend the snowmobiling season, trails should be placed, wherever possible, to retain snow cover. Tree lines, woods, valleys, and north-facing slopes are areas that tend to retain snow, and these areas should be sought out for snowmobile trails.

- ◇ Signage: The Iowa Department of Natural Resources has developed uniform signage for snowmobile trails. The DNR's signage scheme should be used for all snowmobile trails. These signs should be installed before the first snowfall and removed in the spring.
- ◇ Maintenance: Snowmobile trails require a significant amount of maintenance, since winter storms can take their toll on trailheads, signage, and the groomed trail itself. Such maintenance issues should be considered during the initial planning stages of the project.
- ◇ Noise abatement: There is the potential for disturbance from snowmobile noise. For this reason, snowmobile trails should be placed as far as possible from residential areas. Other noise abatement possibilities include placing the trail behind existing vegetation or within valleys. In addition, sound monitoring and enforcement should be initiated to ensure that machines do not exceed the legal limits.

—— *Off-Highway Vehicle Trails (3- and 4-wheeled)*

As with snowmobiles, off-highway vehicles (OHVs) are capable of high speeds, and safety is a primary consideration in the establishment of design guidelines. OHV trails may exist as either a nodal or linear facility, with nodal facilities offering looping trails within one designated area or park, and linear facilities offering connections between riding parks, communities, and support services. As with all motorized trails, signing should be used to warn non-motorized users of the predominate use mode. In some situations clearly indicated dual trails can be indicated for the safe sharing of a corridor by motorized and non-motorized users.

The Iowa Department of Natural Resources has recently established a policy regarding the acquisition and development of OHV parks (nodal facilities). This policy is included in Appendix E.

The following guidelines generally hold true for trails in both nodal and linear facilities.

Clear Trail Width

- ◇ Recommended width for a one-way OHV trail in a wooded area: 5 feet (see Figure 4-18).
- ◇ Recommended width for a two-way OHV trail in a wooded area: 8 feet.
- ◇ Recommended width for a one-way OHV trail in an open or grassy area: 4 feet (see Figure 4-19).
- ◇ Recommended width for a two-way OHV trail in an open or grassy area: 8 feet.
- ◇ Trail width on switchbacks or in areas with steep side slopes should be increased by 6 to 20 inches.
- ◇ On sharp curves, trail width should be increased by 1 foot.

FIGURE 4-18: TRAIL DIMENSIONS FOR ONE-WAY OHV TRAILS IN WOODED AREAS

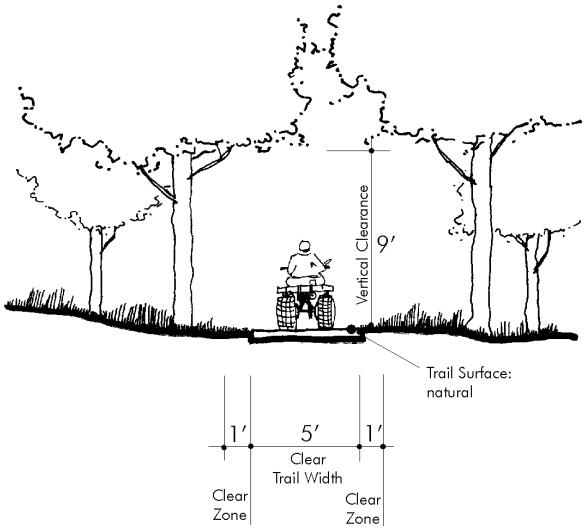
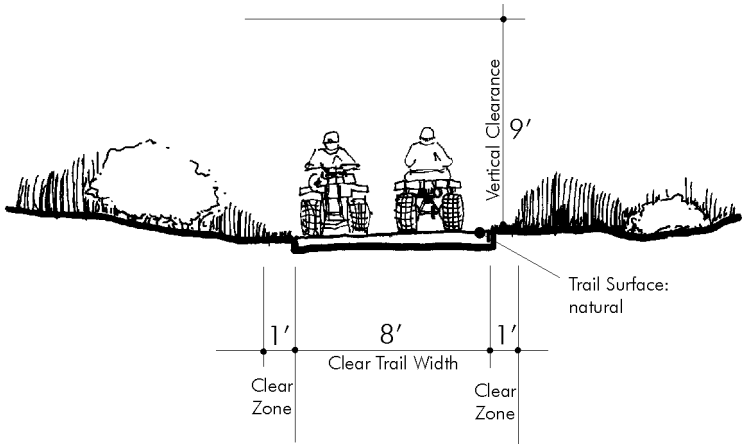


FIGURE 4-19: TRAIL DIMENSIONS FOR TWO-WAY OHV TRAILS IN OPEN AREAS



CLEAR ZONES

◇ OHV trails should maintain a 1-foot minimum clear zone on each side of the trail (see Figures 4-18 and 4-19).

VERTICAL CLEARANCE

◇ OHV trails should maintain a vertical clearance of at least 9 feet (see Figures 4-18 and 4-19).

TRAIL SURFACE

◇ OHV trails should have a natural surface.

◇ OHV trails should be placed on soils that are resistant to erosion. Sandy soils should be avoided. County soil survey maps should be consulted to determine the best location for an OHV trail.

◇ The OHV trail surface should be free of logs, large rocks, stumps, brush, and other obstructions, unless a more challenging experience is desired. In such a case, some obstacles may be left in place.

Drainage

Improper drainage on OHV trails can lead to rutting and severe erosion. Trails can be drained by using changes in grade or rolling drain dips. Waterbars should be used as a last resort, as they increase maintenance costs.

Alignment

- ◇ Minimum radius for curves on OHV trails: 10 feet.
- ◇ OHV trails should be widened slightly at curves for safety reasons (see "Clear Trail Width" above).

Profile

- ◇ Variety in grades for OHV trails is recommended, as it increases the challenge and desirability of the trail, and facilitates drainage.
- ◇ Minimum slope for OHV trails (for drainage purposes): 2 percent.
- ◇ Maximum continuous slope for OHV trails: 8 percent.
- ◇ Maximum grade for shorter slopes (100 feet) on OHV trails: 15 percent.

Edge Protection

Edge protection is not usually required for OHV trails. In areas where safety is of great concern, fences should be installed.

Other Points to Consider

- ◇ OHV parks: Facilities specifically designated for OHV use can offer great challenge and variety. Such parks are typically designed with a system of loops, beginning at a trailhead and possibly offering several loops of different ability levels. OHV parks are likely to be shared by motorcyclists, so loops should be planned for these users, as well.
- ◇ Erosion: To reduce the potential of erosion, OHV trails should avoid unstable soils and provide adequate drainage, especially on steep slopes and hillsides.
- ◇ Noise abatement: OHVs may reach noise levels significantly higher than allowed by the Code of Iowa. Natural buffers such as hills, ridges, and existing vegetation can help to mitigate noise impacts. To reduce noise conflicts, OHV parks should have regular sound level monitoring to ensure all OHVs comply with the Iowa Code.

Motorcycle Trails

Motorcycle trails are very similar to OHV trails in that they both accommodate motorized recreational vehicles. These two trail modes often use the same facilities, the only exception being motorcycle-only trails located in OHV riding areas (see "Other Points to Consider" above). The following guidelines relate only to variations in trail width, alignment, and profile associated with motorcycle-only trails. For all other trail elements, guidelines for OHV trails should be followed. As with all motorized trails, signing should be used to warn non-motorized users of the predominate use mode. In some situations clearly indicated dual trails can be indicated for the safe sharing of a corridor by motorized and non-motorized users.

Clear Trail Width

- ◇ Recommended width for a one-way motorcycle trail in a wooded area: 3 feet.
- ◇ Recommended width for a two-way motorcycle trail in a wooded area: 6 feet (see Figure 4-20).
- ◇ Recommended width for a one-way motorcycle trail in an open or grassy area: 2 feet (see Figure 4-21).
- ◇ Recommended width for a two-way motorcycle trail in an open or grassy area: 6 feet.
- ◇ Trail width on switchbacks or in areas with steep side slopes should be increased by 6 to 20 inches.
- ◇ On sharp curves, clear trail width should be increased by 1 foot.

FIGURE 4-20: TRAIL DIMENSIONS FOR TWO-WAY MOTORCYCLE TRAILS IN WOODED AREAS

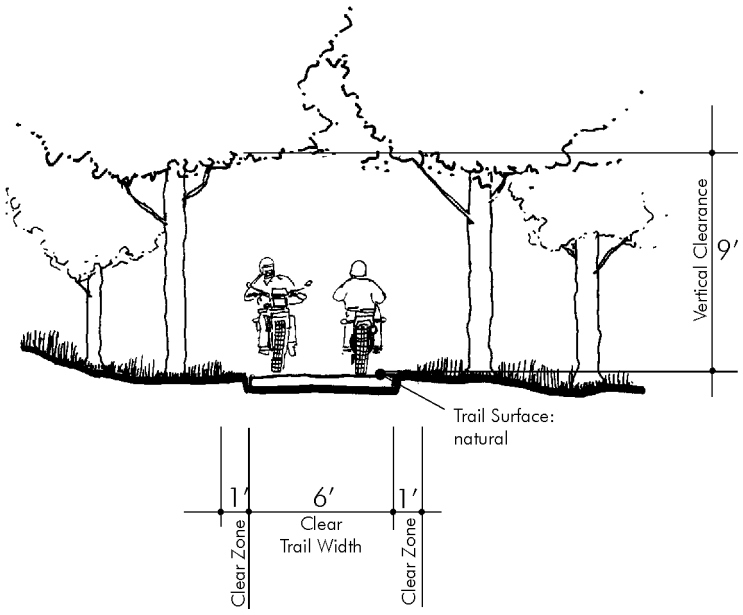
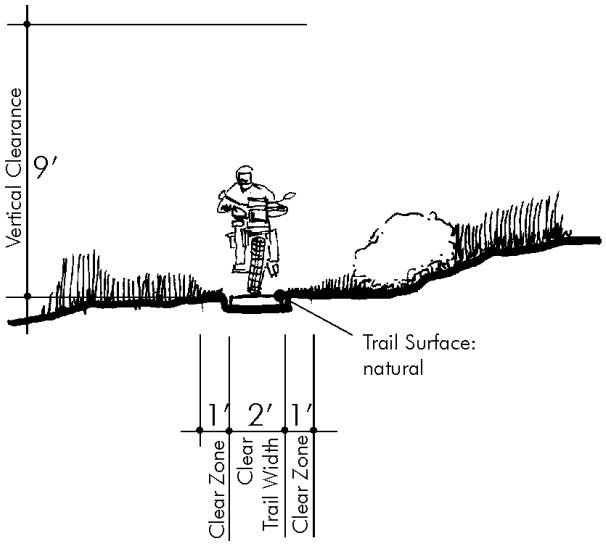


FIGURE 4-21: TRAIL DIMENSIONS FOR ONE-WAY MOTORCYCLE TRAILS IN OPEN AREAS



ALIGNMENT

- ◇ Minimum radius for curves on motorcycle trails: 6 feet
- ◇ Motorcycle trails should be widened slightly at curves for safety reasons (see "Clear Trail Width" above).

PROFILE

- ◇ Variety in grades for motorcycle trails is recommended, as it increases the challenge and desirability of the trail, and improves drainage.
- ◇ Minimum slope for motorcycle trails (for drainage purposes): 2 percent.
- ◇ Maximum continuous slope for motorcycle trails: 12 percent.
- ◇ Maximum grade for shorter slopes (100 feet) on motorcycle trails: 30 percent.

In reality, many of the trails implemented in the state of Iowa will be multi-use trail corridors. The classic example of a recreational trail – a long linear pathway connecting parks or communities – is a multi-use trail used by bicyclists, walkers, in-line skaters, and, possibly, snowmobiles in the winter. There are two types of multi-use trails:

- **SINGLE-TREADWAY CORRIDORS** have only one trail facility, which is planned to accommodate all desired modes.

- **DUAL-TREADWAY CORRIDORS** accommodate a variety of modes on two or more different trails.

The former example is the most cost effective, but can only be used when the user modes are reasonably compatible with each other. The latter example allows for separation of uses within a corridor. This can reduce conflict and still accommodate varied users. The dual treadway corridor may also provide the same support services, such as trailheads, restrooms, and rest areas, for many different users, thereby economizing trail development. It does, however, require a wider right-of-way.

SINGLE-TREADWAY CORRIDORS

Single-treadway corridors are the simplest type of trail, providing a single recreational facility within a corridor that may not be much wider than the trail itself. On these types of facilities, it is important to control the uses that take place, as incompatible user modes will cause serious conflict on a relatively narrow facility.

Compatible Modes

The following are examples of user modes which may occur on the same single-treadway corridor. There may be other possibilities, depending on the design of the trail and community desires.

- Pedestrians, bicyclists, and in-line skaters on a paved multi-use trail facility. This is the classic example of a multi-use trail, and conflicts are relatively rare. Depending on the volume of traffic, however, pedestrians may need to be separated from faster moving bicyclists and skaters for their own safety (see "Pedestrian Trails" beginning on page 4-26).
- Pedestrians and bicyclists on a granular trail with snowmobiles in the winter. The seasonal offset of these uses makes them compatible.
- Pedestrians, bicyclists, and in-line skaters on a paved trail with snowmobiles in winter. The sharing of a trail in this way is possible, but snowmobiles with studs may cause severe damage. In some areas, paved trails are plowed to provide a recreation or transportation amenity even in winter. In this case, snowmobiles must be disallowed.
- Equestrians and snowmobiles. The seasonal offset of these uses makes them compatible.

Guidelines

The guidelines for single-treadway corridors are simple: of the user modes planned, the most stringent guidelines should be used. If pedestrians are one of the designated users of the corridor, accessible facilities should be developed that meet the needs of older adults and people with disabilities. This should hold true even if pedestrians are not the primary trail users. This applies even to multi-use trails where users have a seasonal offset.

—— *Dual-Treadway Corridors*

Dual-treadway corridors are used when incompatible uses coexist in the same corridor. In these cases, it is important to provide more than one trail, each tailored to the unique needs of a use mode or group of use modes.

Incompatible Modes

Incompatible uses may be a result of drastically differing speeds, trail surface needs, or volume of users. The following list of incompatible modes shows those uses which warrant separate treadways if both are planned in one corridor.

- Bicyclists/pedestrians and equestrians. These two user types have different requirements for trail surface, and bicycles and pedestrians may frighten horses.
- Bicyclists/pedestrians and OHV/motorbike users. These two user types have greatly different average speeds, which could create hazards for both groups. In addition, the two groups require different trail surfaces.
- Equestrians and OHV/motorbike users. Despite the similarity of trail design for these two modes, the speed and noise of OHVs and motorbikes could frighten horses.
- Pedestrians and bicyclists/in-line skaters. If traffic volume on a trail is very high, dangerous conflicts can occur. In cases of high traffic volume, the multi-use trail should be split into separate trail facilities for these two groups (see "Bicycle Trails" beginning on page 4-29 and "Pedestrian Trails" beginning on page 4-26).

GUIDELINES

When dealing with dual treadways, there are two issues to consider.

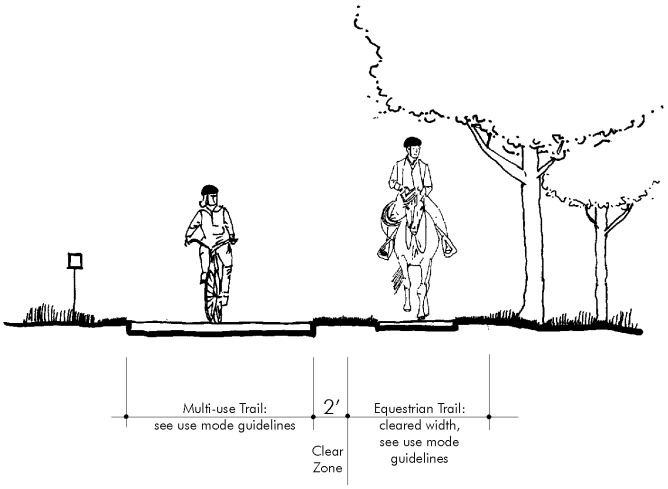
- The design of each treadway.
- The separation of the various treadways.

The design of each treadway is similar to that described above under "Single-Treadway Corridors." Each treadway should follow the most stringent guidelines, based on the user modes it will host. In addition, each treadway should be wide enough to permit users to travel in both directions.

The separation of treadways varies with local conditions and planned user modes. The following is a brief list of some common dual-treadway corridors and recommended separations.

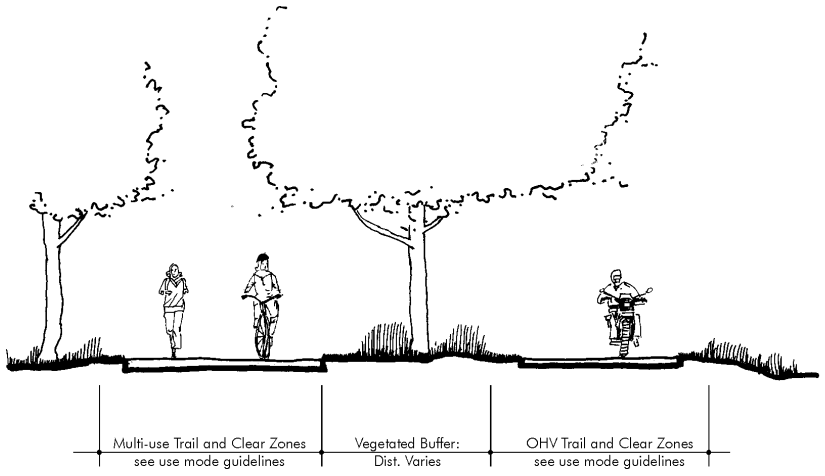
◇ Separation between multi-use trails and equestrian trails: 2 feet or greater, possibly with a fence or planted median between them (clear zones from each trail to any fence or tree should be maintained) (see Figure 4-22).

FIGURE 4-22: MULTI-USE AND EQUESTRIAN TRAILS



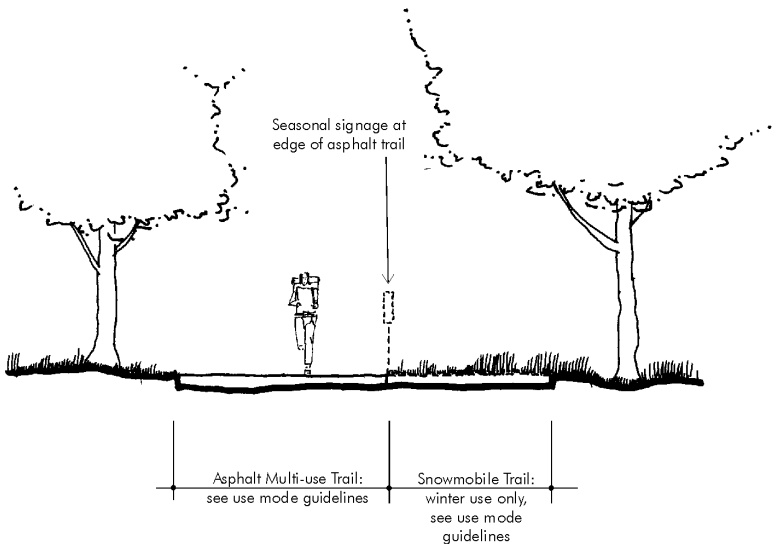
◇ Separation between multi-use trails and OHV/motorbike trails: distance is variable, but a vegetative buffer or fencing should be provided (see Figure 4-23).

FIGURE 4-23: MULTI-USE AND OHV TRAILS



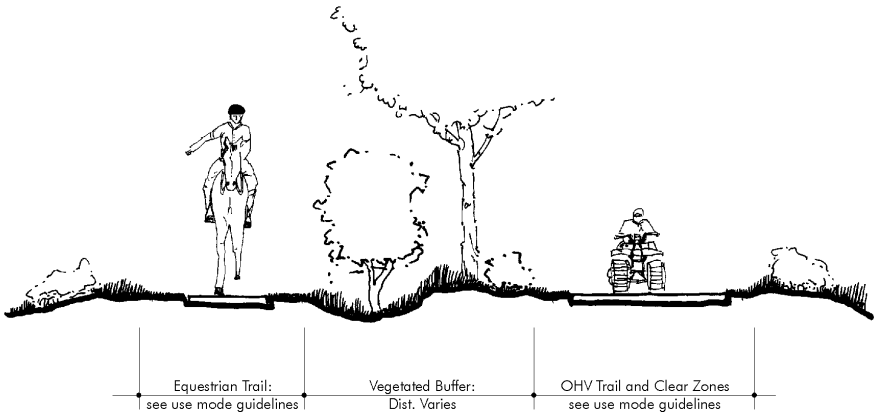
◇ Separation between paved trails and adjacent snowmobile trails: none required, but edge of paved surface should be clearly marked in winter (see Figure 4-24).

FIGURE 4-24: MULTI-USE AND SNOWMOBILE TRAILS



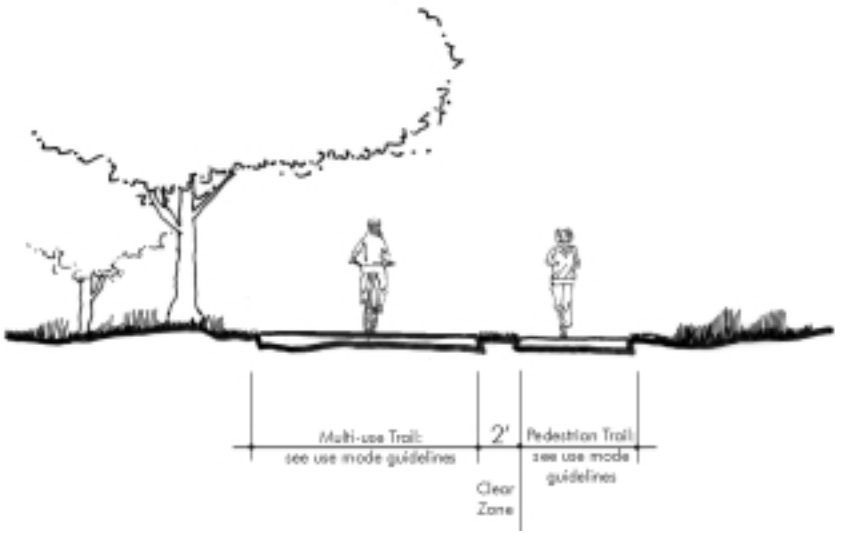
◇ Equestrian and OHV/motorbike trails: as far apart as possible, with vegetative buffer or fencing provided (see Figure 4-25).

FIGURE 4-25: EQUESTRIAN AND OHV TRAILS



◇ Pedestrian trails and bicycle/in-line skating trails: at minimum, a solid white stripe; 2-foot break in pavement preferred (see Figure 4-26).

FIGURE 4-26: MULTI-USE TRAIL WITH SEPARATED PEDESTRIAN TREADWAY



DESIGN GUIDELINES FOR CROSSINGS

The greatest potential safety hazard to trail users is when a trail crosses a roadway, railroad, watercourse, or another trail. The best way to increase safety is to increase visibility. It is important that crossings are visible both to trail users and to motorized vehicles. There are two types of crossings: at-grade and grade-separated. Of these, grade-separated crossings are necessary for watercourses, and strongly recommended for high-volume roadways. At-grade crossings are appropriate where motorized traffic volumes are low or local conditions prohibit grade separation.

In any case where a trail will need to cross a roadway, the crossing should be evaluated to determine whether a grade-separated crossing is warranted. This determination will generally be based on roadway capacity, roadway speed, trail capacity, sight distances, and accident history. The FHWA's Manual on Uniform Traffic Control Devices offers guidance on the evaluation of crossings. Primarily in the case of major roadways, a detailed engineering study should be undertaken in the design of the crossing, especially if it is to be at grade, to ensure proper stopping distance, crossing visibility, and sight lines from the trail.

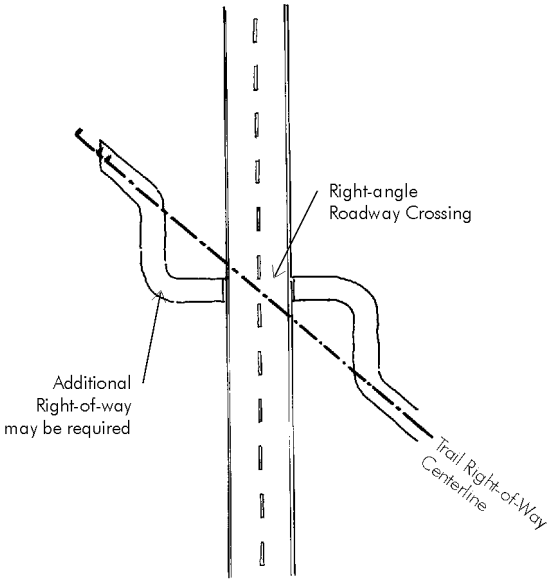
At-Grade Crossings

As discussed above, at-grade crossings should be used when roadway traffic volumes are low, where trails cross roadways at existing traffic signals, or when local conditions restrict the ability to implement a grade-separated crossing.

Crossing Layout

FIGURE 4-27: ROADWAY CROSSING LAYOUT

Wherever possible, trails should cross roadways and railroads at right angles. In cases where trails approach the roadway at a skew, the trail should be routed to achieve a right-angle crossing wherever possible (see Figure 4-27).



Sight Lines

It is important for motorists and trail users to be able to see each other at roadway crossings. A motorist needs to be able to stop in time if a trail user is in the road, and a trail user needs to be able to judge his or her ability to cross the street safely. The AASHTO Policy on Geometric Design of Highways and Streets (Green Book) offers detailed information on determining and planning sight distances at roadway crossings.

Signage, Striping, and Signals

There are three basic components of at-grade crossings.

- Signage
- Striping or pavement markings
- Signals

These three components announce the crossing for both trail users and motorists, and should be employed in varying degrees depending on the functional classification and traffic volume of the roadway to be crossed.

Signage should be based on the FHWA's Manual on Uniform Traffic Control Devices, and be placed outside the recommended clear zones for both trails and roadways. Striping refers to markings painted on the pavement, either on the roadway or on the trail. This includes marked crosswalks and "BIKE XING" lettering. Signals include regulatory traffic lights, such as flashing yellow warning lights, stoplights, or pedestrian crossing signals.

Roadway Crossings

The roadway crossing guidelines described here are divided into five categories based on general functional classifications and roadway volumes. The recommendations for each type of crossing are only a minimum requirement. Each situation must be analyzed in detail to determine whether additional safety signing, striping, or signals are warranted. All roadway crossings should include the following items:

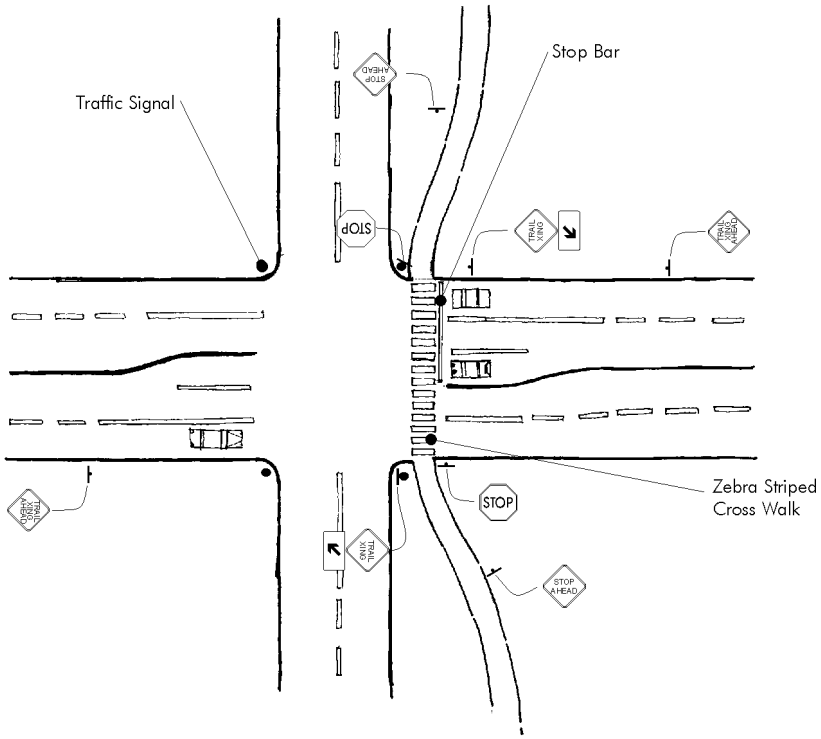
- ◇ Clear sightlines
- ◇ Flush transitions between the trail and the roadway
- ◇ A 3 foot strip of detectable warnings (i.e. truncated domes) as defined in the Americans with Disabilities Act Accessibility Guidelines (ADAAG).

Arterial roads are the largest type of road barring restricted access highways. They typically have a very high traffic volume traveling at very high speeds. They often have more than one lane in

each direction. The following elements should be included in crossings of arterial roads (see Figure 4-28):

- ◇ Crossings at signals only
- ◇ Marked crosswalks
- ◇ Cautionary and regulatory signage on trail

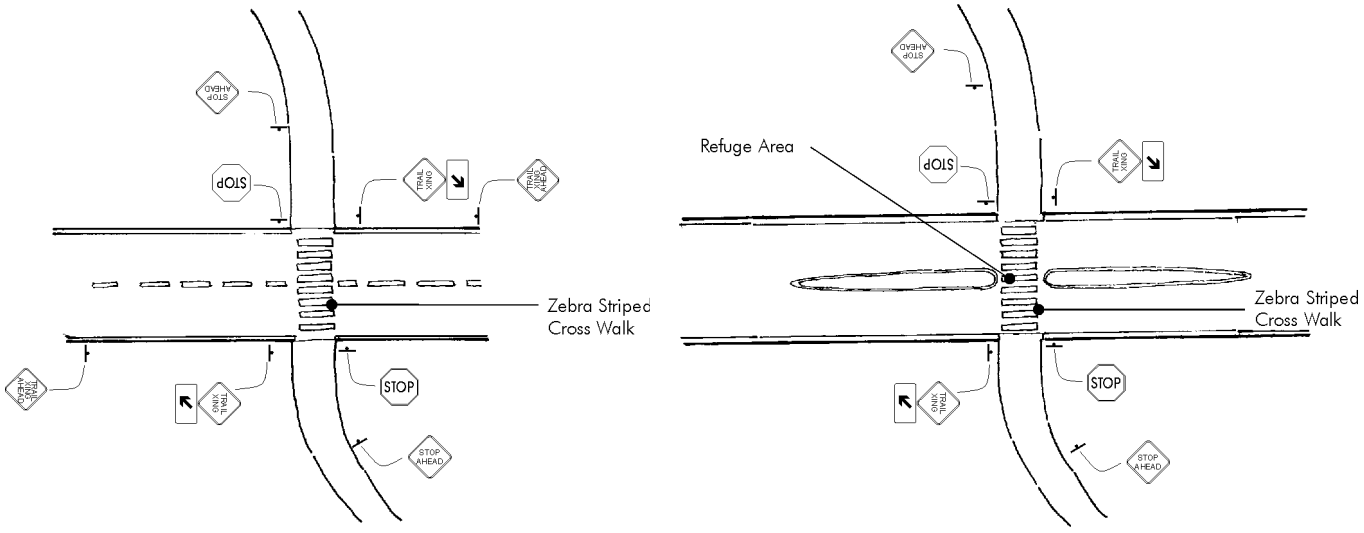
FIGURE 4-28: CROSSING LAYOUT FOR ARTERIAL ROADS



COLLECTORS are streets of moderate size that either serve as secondary connections within communities or as primary routes in rural parts of the state. These roadways may have high traffic speed but typically have lower volume than arterial roads. They often have only one lane in each direction, but may be wider in congested areas. The following elements should be included in crossings of collectors (see Figure 4-29):

- ◇ Crossings at signals, at controlled intersections, or mid-block with flashing lights
- ◇ Marked crosswalks
- ◇ Cautionary and regulatory signage on trail
- ◇ Cautionary signage on roadway

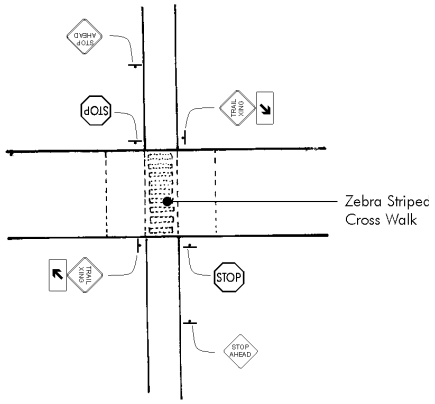
FIGURE 4-29: CROSSING LAYOUT FOR COLLECTORS



RESIDENTIAL STREETS are roadways with low traffic volume and speed. They are found within communities and are designed to serve local residents. The following elements should be included in crossings of residential streets (see Figure 4-30):

- ◇ Cautionary and regulatory signage on trail
- ◇ Cautionary signage on roadway
- ◇ Marked crosswalks if trail or roadway traffic volume is high, or if safety concerns exist

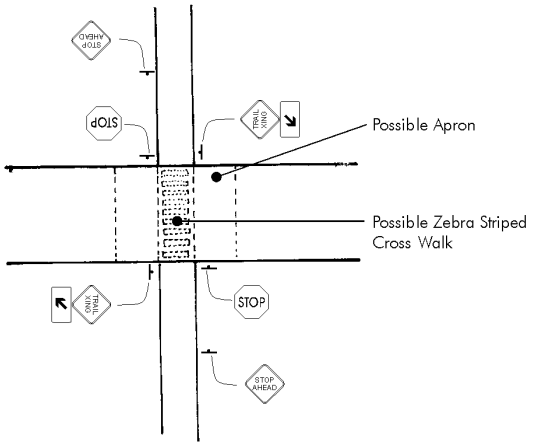
FIGURE 4-30: CROSSING LAYOUT FOR RESIDENTIAL STREETS



RURAL ROADWAYS serve, as their name suggests, rural portions of the state. They are primarily used as connections to and from agricultural areas. They may have either a paved or a granular surface. They have low traffic volume but traffic may travel at high speeds. The following elements should be included in crossings of rural roadways (see Figure 4-31):

FIGURE 4-31: CROSSING LAYOUT FOR RURAL ROADWAYS

- ◇ Cautionary and regulatory signage on trail
- ◇ Cautionary signage on roadway
- ◇ Marked crosswalks
- ◇ If trail is paved and roadway is not, the trail should be paved across the roadway



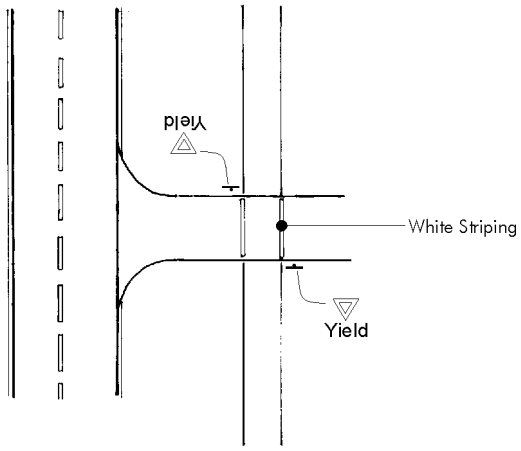
ACCESS DRIVES provide connections between residential, commercial, industrial, or institutional properties and an adjacent roadway. They serve only one specific property. Traffic volumes are typically low and travel at slow speeds. Trails adjacent to roadways

may cross numerous access drives, depending on the density of the surrounding land use. The following elements should be included in crossings of access drives (see Figure 4-32):

◇ Cautionary signage on trail

◇ Trail may be striped across driveway

FIGURE 4-32: CROSSING LAYOUT FOR ACCESS DRIVES



On-Road Bicycle Facilities at Intersections

Where bicycle lanes, shared roadways, or paved shoulders intersect with other roadways, they are regulated by the traffic control devices installed at the intersection. This increases safety, as bicyclists are apparent to motorists and are following the same rules. Because on-road bicycle facilities are typically found on the right shoulder, however, right-turn lanes, left-turning bicycles, and ramps of any kind can impact the safe operation of bicycles on the street.

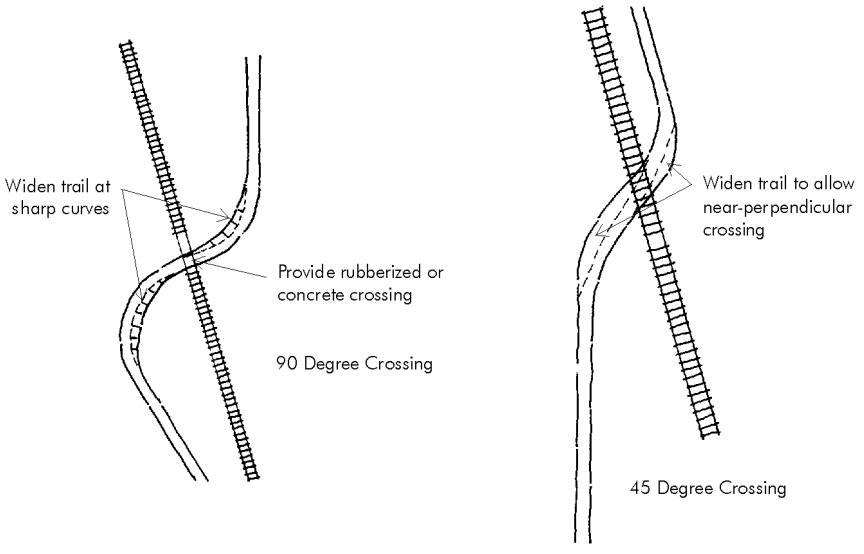
The AASHTO Guide details several options for the accommodation of bicycle lanes at intersections. Bicyclists on shared roadways and paved shoulders, lacking dedicated bicycle facilities along their route, should progress through the intersection according to existing traffic signage and signals.

Railroad Crossings

In many ways, railroad crossings are similar to roadway crossings, except that sight lines for trail users are even more important. As with roadway crossings, trails should cross railroads at right angles, if possible. For many trails, however, this is not likely to be the case, especially for trails within road rights-of way. Bicycles and in-line skaters, in particular cannot cross railroads at a severe angle, because the gap between the pavement and the rail may trap a wheel. The AASHTO Guide details several options for mitigating severely angled railroad crossings (see Figure 4-33).

For paved trails, the railroad track is often set into the surface material. In these situations, the railroad crossings should include a rubberized crossing material, to provide a long-term smooth ride for trail users. For unpaved trails, a ramp leading up to the railroad tie should be developed with a 5 by 5 foot level landing on either side of the track. A rubberized crossing material is also recommended for unpaved trails to minimize maintenance of the railroad crossing.

FIGURE 4-33 RAILROAD CROSSING LAYOUTS



The opening created by the railroad flangeway should also be addressed if possible. Recently a rubber insert, known as a flangeway filler, has been developed that deflects downward with the weight of a train, but provides a smooth crossing for other users. Currently, flangeway fillers are only available for slower rail speeds.

Agricultural Crossings

Some trails, especially those on abandoned rail lines, may separate parcels of land owned by the same person. When this land is agricultural, it is necessary for the adjacent landowner to cross the trail to access both parcels. Such a crossing should consider the following recommendations.

- ◇ Sight lines, as based on the AASHTO Green Book, should apply to agricultural crossings. The design speed depends on the trail mode considered, but should adhere to the most stringent standard, as mentioned under "Multi-Use Corridors" beginning on page 4-54.
- ◇ Access from the crossing to the adjacent land should be gated, if desired by the landowner, to prevent trail users from perceiving the access road as a spur trail or rest area.
- ◇ In some cases, especially with paved trails, a stronger trail cross section should be constructed in the vicinity of the crossing, so it will not degrade from repeated crossings by heavy equipment.
- ◇ Trails should be signed to indicate the existence of an agricultural crossing.

Crossings of Other Trails

When trails cross one another, users sometimes face specific hazards and require additional information. This is especially true when trails that accommodate different modes intersect. The following recommendations, based on those in the FHWA's Designing Sidewalks and Trails for Access: Best Practices Design Guide, improve safety and provide direction for all users.

- Offset the trail intersection and create two three-way intersections rather than one four-way intersection.
- Design the physical connection between the two trails surfaces to be level and smooth.
- Provide signs at the intersection that clearly indicate the desired direction of travel and the numerous possible destinations (including their distances).
- Provide sign formats in high use areas, such as audible recording devices, that are accessible to individuals with vision impairments and those who have limited ability to read text.
- Clearly indicate through signs or barriers the allowed user groups on each trail.
- Provide objective sign information about the conditions of each trail.

GRADE-SEPARATED CROSSINGS

Grade-separated crossings are much safer than at-grade crossings, and should be employed where high traffic volumes exist on the roadway or the trail. There are five types of grade-separated crossings.

- Roadway underpasses
- Agricultural underpasses
- Roadway overpasses
- Bridges over watercourses and other independent trail bridges
- Wetland boardwalks

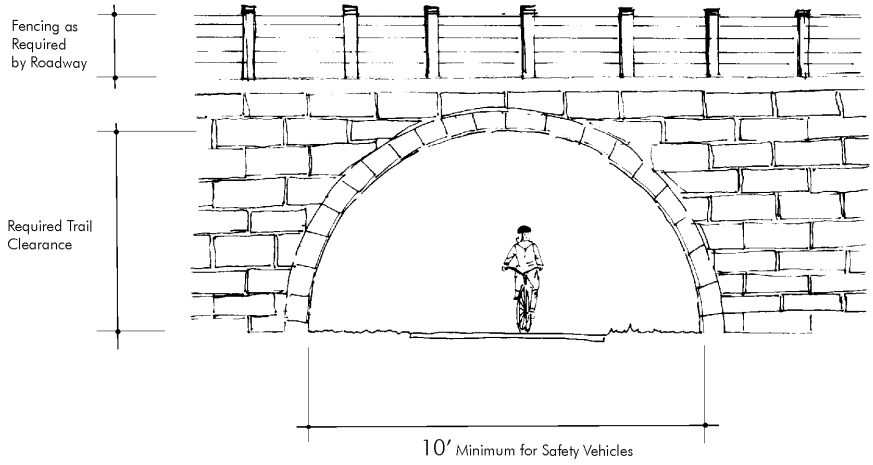
ROADWAY UNDERPASSES

One method of accomplishing a grade-separated crossing of a roadway or railroad is to build a tunnel underneath the traveled way. This is a good choice if the roadway is elevated, even slightly, because an overpass would be cost prohibitive in these cases. The following recommendations relate to the general dimensions of the underpass. The final design of such a facility requires the consultation of a professional engineer.

- ◇ Minimum width of underpass: trail width plus clear zones. If the underpass must be accessible to an emergency vehicle, the width of the underpass should be a minimum of 10 feet (see Figure 4-34).
- ◇ Wider underpasses are preferred, since they offer a lighter, safer environment for trail users.

- ◇ An underpass should be sloped so it drains out one of the entrances.
- ◇ An underpass should be graded so that exterior surface water is diverted away from the underpass.
- ◇ Good lighting should be provided to increase user comfort and minimize crime.
- ◇ Users should be able to see the other side upon entering the underpass.
- ◇ Long sight lines at the entrance and exit of the underpass should be provided.

FIGURE 4-34: ROADWAY UNDERPASS DIMENSIONS



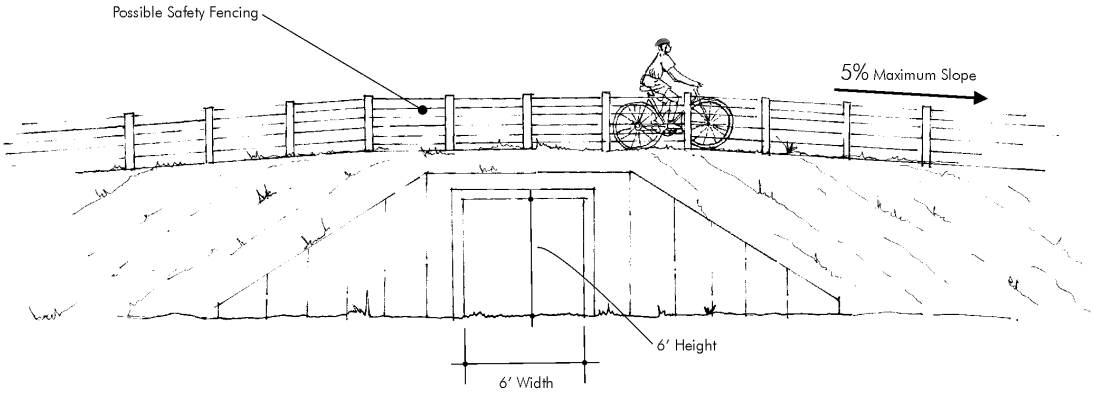
AGRICULTURAL UNDERPASSES

Agricultural underpasses may be considered when adjacent landowners have the need to move livestock between parcels on opposite sides of the trail. They should be used when trail volume is

high and livestock crossing is frequent. Agricultural underpasses are typically large concrete box culverts. The following recommendations relate to agricultural underpasses.

- ◇ Preferred width of agricultural underpass: 6 feet (would allow animals to turn around or travel two abreast) (see Figure 4-35).
- ◇ Preferred vertical clearance of agricultural underpass: 6 feet.
- ◇ The floor of the underpass should be compacted soil.

FIGURE 4-35: AGRICULTURAL UNDERPASS DIMENSIONS



Roadway Overpasses

Roadway overpasses may be stand-alone bicycle/ pedestrian bridges designed to carry trail users over major roadways, or alternatively, shoulders or walkways might be retrofitted to carry trail traffic on existing road bridges. It may be less costly to retrofit an existing bridge with a trail facility than to construct a new trail bridge. However, the space on existing bridges is often very limited and the trail facility will be immediately adjacent to heavy traffic. Separate pedestrian and

bicycle bridges must be designed with care so that they are accessible to those with disabilities and so that they flow naturally from the trail or street facility and will be used. If the facility will be difficult to use, it is preferable to connect the trail facility to the nearest intersection and cross in that location.

- ◇ Recommended width of independent trail bridge: trail width plus recommended clear zones (see Figure 4-36). In order to reduce cost, recommended clear zones may be reduced on independent trail bridges.
- ◇ Recommended width of trail accommodations on new roadway bridge: trail width plus recommended clear zones (see Figure 4-37).
- ◇ Fencing requirements for independent bridges: fencing should be designed to prevent any objects from falling or being thrown onto the roadway below. Trail bridges may have a fully enclosed cage that maintains the recommended vertical clearance, or they may include fencing that is at least 6 feet high (see Figure 4-36).
- ◇ Fencing requirements for trail accommodations on existing bridge: full-height fencing (as described above) on drop-off side of trail; possible barrier on roadway side of trail, depending on traffic volumes.
- ◇ There should be a flush transition between the trail and the trail bridge.
- ◇ Maximum approach grade for new bridges: 5 percent.
- ◇ Design loading: heaviest vehicle that will cross the bridge, including maintenance vehicles.

FIGURE 4-36: INDEPENDENT TRAIL BRIDGE OVER HIGHWAY

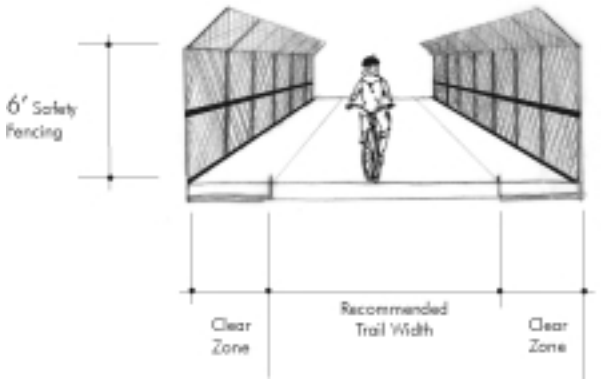
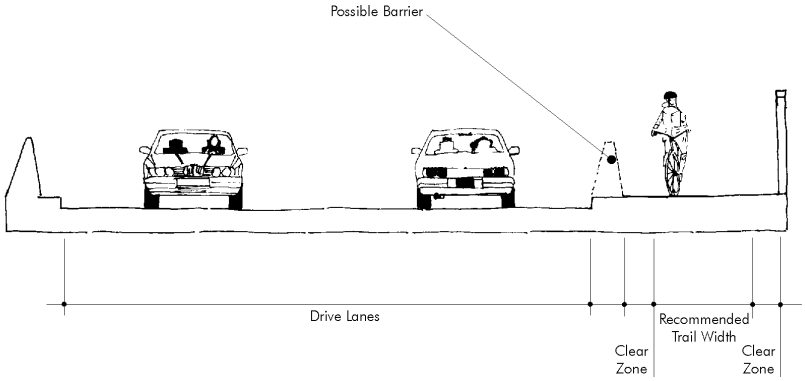


FIGURE 4-37: TRAIL ON NEW ROADWAY BRIDGE



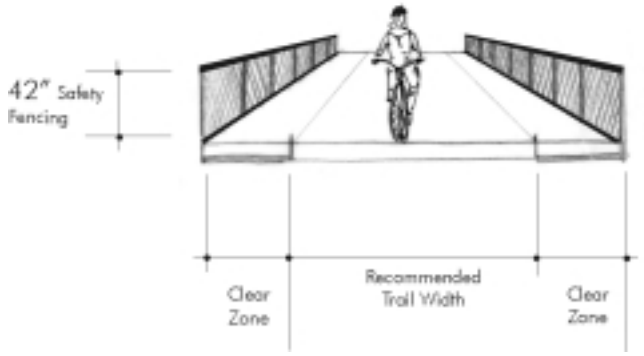
BRIDGES OVER WATERCOURSES AND OTHER INDEPENDENT TRAIL BRIDGES

The guidelines for bridges over watercourses are much like those for roadway overpasses. The main consideration in designing bridges over watercourses is environmental impact. The following guidelines relate to fencing and to mitigating the potential environmental impacts of bridges. For guidelines on width, approaches, and design loading, see "Roadway Overpasses" above.

◇ Reduce the amount of fill in the floodplain by setting bridge abutments as low as possible. The floodplain slope is a good location for bridge abutments, as the trail can progress across the watercourse at a relatively level grade.

- ◇ Avoid setting bridge piers directly in the watercourse. This could disrupt flow and trap debris.
- ◇ Design bridges with as few piers as possible.
- ◇ Fencing requirements for bridges over watercourses: 42-inch fencing on both sides of trail, with a side barrier at trail level to prevent wheels and runners from dropping off the edge of the bridge (see Figure 4-38).
- ◇ There should be a flush transition between the trail and the trail bridge

FIGURE 4-38: INDEPENDENT TRAIL BRIDGE



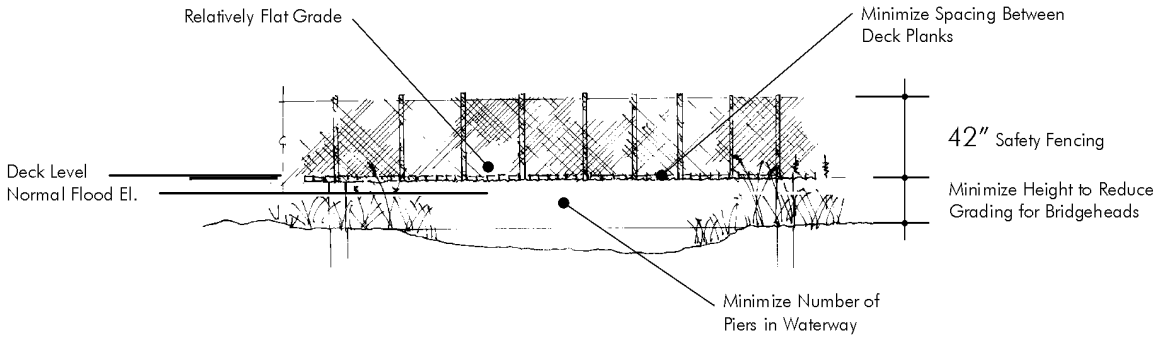
Wetland Boardwalks

In general, trails should avoid wetlands whenever possible. Occasionally, however, for interpretive purposes or out of necessity, a trail may cross a wetland. It is prohibited by federal law to fill the wetland without mitigating the impact elsewhere. Even with mitigation, however, a filled trail corridor would sever the wetland, drastically affecting its hydrology. The trail could be built on an elevated

boardwalk for the entire length of the delineated wetland. A boardwalk may follow the same general guidelines set forth for bridges. The following recommendations relate specifically to wetland boardwalks.

- ◇ The wooden trail surface of the boardwalk may cause problems for some user modes. Wood slats should be placed as close together as possible while still allowing for drainage between them.
- ◇ The planks of the boardwalk should be perpendicular to the dominant direction of travel to prevent bicycle tires and wheelchair wheels from becoming stuck in the openings.
- ◇ Understanding that traction by many trail modes on wood (especially wet) is less than on pavement or natural surface, curves and angles should be very slight.
- ◇ Because some wetlands have fluctuating water levels, the trail surface should be located above the normal high water line of the wetland. Floating boardwalks may also be used to accommodate fluctuating water levels (see Figure 4-39).
- ◇ Fencing requirement for wetland boardwalks: 42-inch fencing on both sides of trail, with a side barrier at trail level to prevent wheels and runners from dropping off the boardwalk (see Figure 4-39).

FIGURE 4-39: WETLAND BOARDWALK



SUPPORT SERVICES

Besides the trail itself, there are other facilities that increase the quality of the user experience. These amenities are collectively known as support services, and they fall into three general types.

- Trailheads and access points
- Rest areas
- Interpretive facilities

The importance of these facilities is sometimes overlooked, but they should be incorporated into the initial and final planning of all trail projects. The quantity, spacing, specific facilities, and size of these support facilities will vary depending on a trail's proximity to cities and towns, the traffic volume of the trail, the type of use, and environmental considerations. The following guidelines give a general overview of what and how many support services should be included in trail projects, but each project must be evaluated on a case-by-case basis to determine the best balance of facilities and cost.

Trailheads and Access Points

Trailheads refer to parcels specifically designed as primary means of accessing a trail. They may include restrooms, maps, parking, picnic facilities and other recreational amenities. Access points refer to minor connections between the trail and nearby parks, communities or roadways. Access points are important because many trails will run for long stretches surrounded by private property, and access should be provided wherever possible, but controlled so that ad hoc trails do not occur on private land. Some access points are automatic, such as

when trail crosses a roadway and others may be carefully planned and implemented, such as a connection to a trail which would require a railroad crossing.

When developing trailheads and access points, it is important that designers recognize that people with disabilities enjoy all types of trails in addition to pedestrian facilities and hiking trails. Furthermore, people with disabilities participate in trail activities at a wide range of skill levels. Therefore it is recommended that an accessible pathway be provided to all trailheads and access points, regardless of the permitted use modes. Furthermore, built facilities, such as restrooms and parking lots, should be designed according to the ADA accessibility guidelines.

The following guidelines relate to the development and placement of trailheads and access points.

- ◇ Trailheads should be placed at each terminus of a trail corridor, and any place where a large concentration of trail users is expected, such as at towns or major parks along the trail.
- ◇ An accessible pathway should be developed that connects parking and other accessible elements to the trailhead.
- ◇ Trailheads should at least include parking and a trail map, but may also include restrooms, drinking water, picnic facilities, horse tie-ups, and other recreational amenities.
- ◇ Trailheads associated with equestrian, snowmobile, OHV, and motorcycle trails should provide parking and turn-around space for trailers, and snowmobile trailheads should be cleared of snow.
- ◇ Trail access points should be placed wherever trail access is expected, such as at adjacent communities, schools, commercial areas, and parks.

◇ Trail access points should include signage identifying the trail (see "Signage" beginning on page 4-81), and may include a map and drinking water. Limited parking may also be included, but because trail access points are designed to give access from local amenities to the trail, it may be unnecessary.

——*Rest Areas*

Rest areas are generally small support facilities located along a trail, which do not provide access to surrounding amenities. Rest areas are places to stop and rest off the main traveled way of the trail. They may also serve as interpretive areas or overlooks. The design of rest areas can be as varied as the trail modes they serve, and the specific design at each location should be considered individually. The following guidelines set forth some general recommendations regarding trail rest areas.

◇ Trail rest areas should at least include a seating area and a place to park the trail vehicle (snowmobile, bicycle, horse, etc.). They may also include drinking water, restroom facilities, and signage. Rest areas on equestrian trails should include hitching posts.

◇ Trail rest areas should be located approximately every half hour of travel time. The distance between rest areas is dictated by the use modes on the trail.

◇ Trail rest areas should be located after any prolonged uphill slope, especially for bicycle and walking trails.

Interpretive Facilities

Part of the draw to a trail is to gain an understanding of the environment through which it passes. Many trails will offer the opportunity to educate the user on various aspects of the landscape, including native plants and animals, geologic history, local history, and local economy. Interpretive facilities should offer a view of the item to be interpreted, whether that be the agricultural landscape in general or a specific type of tree. Some trails may capitalize on many interpretive opportunities, while others may offer them as educational diversions incorporated into rest areas. Each trail's interpretive program is different and the extent of interpretation should be based on the use of the trail, with interpretation facilities decreasing as user speeds increase. The following guidelines offer some general suggestions regarding interpretive facilities.

- ◇ Interpretive facilities should include signage with ample graphics, to engage users of all ages. They may also include any of the rest area facilities listed above.
- ◇ Consideration should be given to providing interpretive information in a format that is accessible to people with vision impairments and people with limited English skills. This may include providing objects that can be examined or manipulated, or providing audio information in addition to written information.
- ◇ Interpretive facilities should be placed wherever there is a significant cultural, historical, or natural phenomenon.
- ◇ Small interpretive facilities may be implemented more frequently if user speeds are low, as on walking/hiking trails.

SIGNAGE

Signage increases safety and comfort on trails. The inclusion of signage on trails is an important amenity not to be overlooked. Signs may assist in the navigation of a trail or trail system, warn of approaching roadway crossings, regulate trail use, or interpret natural features. The Manual on Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration is an invaluable reference for standard signage. Whereas this document is generally geared for roadway use, many of the signs may be adapted for trail use. In addition, the signs listed in the MUTCD are an industry standard and can be easily fabricated. There are five basic types of signs.

- **DIRECTIONAL SIGNS** give street names, trail names, direction arrows, mileage to points of interest, and other navigational information.
- **CAUTIONARY SIGNS** warn of upcoming roadway crossings, steep grades, blind curves, and other potential trail hazards.
- **REGULATORY SIGNS** tell the "rules of the trail" by prohibiting certain uses or controlling direction of travel.
- **INTERPRETIVE SIGNS** offer educational information on the trail environment (these are covered in further detail under "Interpretive Facilities" on page 4-80).

- **OBJECTIVE SIGNS** provide information about the actual trail conditions, including grade, cross slope, surface, clear trail width and obstacle height. This allows users to make more informed decisions about which trails best meet their trail needs and abilities. For example, a wheelchair user may be able to travel over very steep grades provided the trail is at least 36 inches wide. Learning this information at the trailhead will help this user avoid the potential frustration of having to turn back if the trail becomes too narrow.

Signage at roadway crossings is covered in "At-Grade Crossings" beginning on page 4-60. Other regulatory, cautionary, and directional signs should be placed as needed. The inclusion of signage in a trail project should be planned from the outset, but each project is vastly different, and signage should be considered on a case-by-case basis. The following guidelines relate to the general placement and design of trail signage.

- Signs should be placed where they will be clearly visible. Placement is dependent on the sight lines (relative to user speed) of each trail.
- Signs should be placed at a constant distance from the trail edge, 3 feet 6 inches is preferred.
- Lettering less than two inches in height is not recommended for directional signs.
- Text should be avoided on regulatory or cautionary signs wherever possible.
- Multiple signs may be mounted on the same post, but the primary message should be in the top position on the post.

As discussed under "Snowmobile Trails" beginning on page 4-43, the Department of Natural Resources has developed standard signage for snowmobile trails. This removable signage should be used in locations where snowmobile trails are not used in the summer. If the snowmobile trail is shared by other uses, permanent signage should be installed. This permanent signage may be supplemented with removable seasonal snowmobile signage, if necessary.

DESIGNATION OF CANOE ROUTES

The Department of Natural Resources has been active in the inventory of state recreational water resources and the establishment of canoe routes. Canoe routes should be designed to offer the safe and reliable passage of a canoe or kayak. Routes may offer trips of varying lengths, from day trips to multi-day overnight excursions.

The primary considerations in the designation of canoe routes include adequate signage and support facilities, and the reasonable expectation that the waterway can accommodate small watercraft most of the time. The following guidelines describe the minimum level of development of a canoe route to accommodate the needs of canoe and kayak use:

- ◇ Access points (landings) should be situated at maximum intervals of 5 miles.
- ◇ Camping and sanitary facilities should be situated at maximum intervals of 20 miles.
- ◇ Portages should be kept to a minimum, but, where required, should consist of established landings and a well-drained, natural surface trail that is free from branches, brush, or other obstacles.

◇ Accurate information on the route should be available, including river maps, mileage between services, level of difficulty, and current water levels. This information should be updated frequently.

◇ Signage should be included to direct users to the river, and to inform users on the river. Uniform directional signage should be placed on nearby roadways to advertise landing locations. Uniform signage should be installed along the river to advertise landings, camping facilities, portages, and hazards.